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for the

CONSTRUCTION OF ELECTRICAL WORK

in the

City of Baltimore

INSPECTOR OF BUILDINGS
CONSTRUCTION
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Rules and Regulations

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CONSTRUCTION OF ELECTRICAL WORK

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Ordinances

Issued by

INSPECTOR OF BUILDINGS

1923

PREPARED AND APPROVED BY THE

ELECTRICAL CODE COMMITTEE

OF BALTIMORE, MD.,

CONSISTING OF THE FOLLOWING:

J. F. CROWTHER, Inspector of Buildings of Baltimore City.

A. E. CHRISTHILF, Chief Engineer of Baltimore City.

JOSEPH N. SHEW, Chief Electrical Inspector of Baltimore City.

CHAS. A. JORDING, Fire Board.

EDGAR B. McKNEW, Fire Prevention Bureau.

G. W. WILKINSON, State Board of Electrical Examiners and Supervisors.

G. E. PAINTER, State Board of Electrical Examiners and Supervisors.

FRANK STARK, Electrical Contractors Assoc. of Md.

D. SCOTT AMOLD, Electrical Contractors Association of Maryland.

JOSEPH A. O'BRIEN, Board of Fire Underwriters.

W. BONSALL, Cons. Gas Elec. Lt. & Pr. Co.

J. S. CRUCKSHANK, Cons. Gas Elec. Lt. & Pr. Co.

JOHN S. DOBLER, Electrical Contractors, Dealers Association.

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SECTION OF BUILDING CODE.

Par. 5. *Section* 3.

The Inspector of Buildings is authorized under the City Code and directed to make such rules and regulations for work and materials in the various constructions under the ordinance, and not inconsistent therewith, as may be necessary to carry out the requirements for public safety.

Par 15. *Section* 6.

No electrical work shall be done, no electrical wires shall be placed and no electrical apparatus of any kind shall be installed in any building or structure except central and sub-stations of incorporated electric companies within the corporate limits of the city, or over or upon any avenue, street, alley or other public property within said limits without a permit signed by the Inspector of Buildings.

Par. 25 *Section* 6.

Power permits, including permits for steam-power boilers or engines, gas or gasoline engines, electric generators and motors and all other power generators, and all machinery operated thereby, may be revoked on ninety days' written notice from the Inspector of Buildings, approved by the Mayor, to the owner or person having charge thereof, provided in the judgment of the Inspector of Buildings the provisions of law or ordinance in relation to such permits or in relation to such methods or means of power or of any ordinance relating to the storage of fuel are not complied with, and any person who shall refuse or neglect to conform to the requirements of such a notice, or shall fail to remove such mechinery when required to do so by the Inspector of Buildings, shall be liable to a penalty of not more than $50.00 for every day that such refusal or neglect shall continue after the expiration of ninety days. A separate record shall be kept of all power permits and no steam-boiler or engine, gas or gasoline engine, electric dynamo or motor of five horsepower or over, or any other power generator, or any machinery to be operated thereby shall be installed without such a permit signed by the Inspector of Buildings.

Par. 1. *Section* 7.

The Inspector of Buildings shall be empowered to permit the use of new methods of construction. Electrical or elevator equipment not herein provided for, when after proposed examinations and tests by him said methods are found to be in conformity with good practice and the spirit and intent of this Code.

Par. 14. *Section* 16.

The Inspector of Buildings shall have full power to enter upon any premises or remove any obstacle for the execution of any work under this section.

Par. 61. *Section* 50.

It shall be unlawful for any person or persons to unduly tamper with any electric current, carrying device or wire, or with any fuse or safety device of any kind or any substitute or improper device that may have been improperly placed there, under penalty of $25.00 fine or imprisonment of not less than 30 days in jail.

Par. 67. *Section* 50.

The dead and discarded wires of any system shall be removed from a building or poles where live electric light or power circuits remain in service.

Par. 71. *Section* 50.

If any electric wiring or any device or apparatus requiring the use of electricity in any building or structure shall be defective or out of repair, or is suspected of being so, the Inspector of Buildings, or an inspector acting under his direction, shall inspect such construction.

Par. 74. *Section* 50.

If in his judgment, the defects or repairs that are needed are such that the safety of the building or of other buildings is endangered, he shall notify the electrical contractor or the person in charge of the work, or the owner or person in charge of the building in writing, and if, in his judgment it is necessary, he may condemn the wiring or the device or the apparatus in question, and order its removal or the discontinuance of the current. If the wiring, device or apparatus in

question is not removed as required or the current is not discontinued, the Inspector of Buildings may proceed as in the case of dangerous or partially destroyed buildings, as provided in Section 16 of this Article.

Par. 76. *Section* 50.

The Inspector of Buildings shall have the power to remove any obstruction or covering necessary to the complete inspection of any defective electrical construction or construction suspected of being so, and if such construction is found to be defective or in need of repair a lien for the expense of removing such obstructions or covering may be created and enforced in the same way as provided in Section 16 of this Article.

Par. 78. *Section* 50.

No wires for electric light, power, telephone, telegraph, call service, nor for any other purposes, shall be attached to any roof, chimney, fire-escape or cornice of any building or structure of any kind and when aerial lines run over private property, they shall have a clearance between any roof or platform of any kind of not less than eight (8) feet, and in no case shall any such wire be within 3 feet of any structure or part thereof, except where a wire enters a building for uses in said house.

Par. 80. *Section* 50.

Every owner or person managing or controlling the management of any building in which electric wiring devices or apparatus of any kind are installed, who shall refuse to permit the inspection herein provided, or shall fail to afford the means for such inspection, shall be liable to a penalty of not less than $50.00 nor more than $200.00 for each and every violation thereof.

Par. 81. *Section* 50.

All materials and all work required in the installation of electric wiring devices or apparatus of any kind shall comply with the regulations of the office of the Inspector of Buildings in relation thereto.

Par. 82. *Section* 50.

The Inspector of Buildings shall make rules and regulations for electrical work and materials not inconsistent with this ordinance.

Par. 4. *Section* 44.

All halls, vestibules and passage-ways used as exits in such buildings shall be provided with lighting facilities, and all fixtures relating thereto shall be not less than 7 feet above the floor.

Par. 64. *Section* 45.

A gas jet or an electric lamp shall be provided in every story of every tenement or apartment house hallway and in every bathroom and water closet of such a building. Ample facilities shall also be provided for lighting all apartments with gas or electricity.

Par. 8. *Section* 58.

All buildings or structures used as hotels, apartment, tenement or lodging houses shall have a system of alarm gongs, as called for by this Act, and shall have a room known as the main office of said building or structure approved by the Inspector of Buildings, which office shall have a competent custodian at all hours of day and night in charge thereof. Wire for alarm gongs must be not smaller than number (14) rubber covered and same must be run in the same manner as light wiring.

Par. 35. *Section* 6.

Any owner or other person in charge of a structure who shall undertake any work without a permit as required by this section, or who shall fail to comply with any of the conditions or requirements of any permit issued by the Inspector of Buildings, shall be liable to a penalty of $50.00, and where the offense is a continuing one shall be liable to a further penalty of $10.00 for each day such violation continues, except where in a particular case a different penalty is prescribed in this Article.

Par. 3. *Section* 50.

After final inspection of electric wiring or of any device or apparatus requiring the use of electricity in any building, or other structure, or of the erection and construction of any such wiring, device or apparatus, the Inspector of Buildings shall issue a certificate of inspection to the owner thereof or to his representative. This certificate shall describe the wiring, device or apparatus in question, together with its location and the date of its inspection. It shall state that the requirements of the law or ordinance have been complied with, and that at the time of the inspection the wiring device or apparatus appeared to be in good order and safe condition; but the certificate shall not be construed to lessen the liability or responsibility of the owners or the person in charge thereof, not to attach any liability or responsibility for its safe condition or use to the City of Baltimore. The certificate shall be signed by the Inspector of Buildings.

(1) Generators:

(*a*) Must be located in a dry place.

(*b*) Must never be placed in a room where any hazardous process is carried on, nor in places where they would be exposed to inflammable gases or flyings of combustible materials.

(*c*) Generators which operate at more than 150 volts, and are accessible to others than qualified persons, must have their frames grounded in the manner specified in No. 15A. Where the frames are not grounded, owing to the voltage being below 150, or the generators being accessible only to qualified persons, they shall be permanently and effectively insulated from ground.

(*d*) Constant potential generators, except alternating current machines and their exciters, must be protected from excessive current by safety fuses or equivalent devices of approved design.

For two-wire D. C. generators, single pole protection will be considered as satisfying the above rule, provided the safety device is so located and connected that the means for opening same is actuated by the entire generator current and the action thereof will completely open the generator circuit.

If a generator not electrically driven supplies a two-wire grounded system, the safety device or devices must be so placed as to disconnect the generator from all conductors of the circuit.

For two-wire D. C. generators used in conjunction with balancer sets to obtain a neutral for three-wire systems, a protective device must be installed, which in case of the excessive unbalancing of voltages will operate to disconnect the three-wire system.

For three-wire direct current generators compound or shunt wound, a safety device must be placed in each armature lead, and so connected as to receive the en-

(1) Generators—continued.

tire current from the armature. Fuses will not be acceptable. The safety device must consist of either: (1) a double pole, double coil, overload circuit breaker, or (2) a four-pole circuit breaker connected in the main and equalizer leads, and tripped by means of two overload devices, one in each armature lead.

The safety devices above required must be so interlocked that no one pole can be opened without simultaneously disconnecting both sides of the armature from the system.

(*e*) Must each be provided with a name-plate, giving the maker's name, the rating in kilowatts for D. C., KVA. for A. C., the normal volts and emperes corresponding to this rating, also the speed in revolutions per minute.

(*f*) Terminal blocks when used on generators must be made of approved incombustible, non-absorptive, insulating material, such as slate, marble, or porcelain.

(*g*) The use of soft rubber bushings to protect the lead wires coming through the frames of generators is permitted, except when installed where oils, grease, oily vapors, or other substances known to have rapid deleterious effect on rubber are present in such quantities and in such proximity to generator as may cause such bushings to be liable to rapid destruction. In such cases hardwood properly filled, or preferably porcelain or micanite bushings must be used.

(2) Conductors:

(*For construction rules see Nos. 49 to 57.*)

From generators to switchboards, rheostats or other instruments and thence to outside lines:

(*a*) Must be exposed to view and supported on approved incombustible, non-absorptive insulators or placed in approved metal conduit, tile or other fireproof ducts. Conductors installed in conduit or ducts

(2) Conductors—continued.

where exposed to moisture must be lead sheathed and the sheathing must be grounded. Except for low potential systems the insulation of the several conductors where leaving the metal sheath of cables must be thoroughly protected from moisture and mechanical injury by means of a pothead or some equivalent method.

(*b*) Must have an approved insulating covering as called for by rules in Class "C" for similar work, except that where conductors are closely grouped as on switchboards, in wire towers, cableways, and similar apparatus, the conductors must each have a substantial flame-proof outer covering. Bus-bars if rigidly mounted, may be made of bare metal.

Flameproofing must be stripped back on all conductors a sufficient distance from the terminals to give the necessary insulation for the voltage of the circuit on which the conductor is used.

(*c*) Must, where not in conduit, be kept so rigidly in place that they cannot come in contact. Where they pass through floors or fire walls they must be carried through individual openings in incombustible non-absorptive insulating tubes or their equivalent and not through a common open space.

(*d*) Must in all other respects be installed with the same precaution as required by rules in Class "C" for wires carrying a current of the same volume and potential.

(*e*) In wiring switchboards the ground detector, voltmeter, pilot lights and potential transformers must be connected to a circuit of not less than No. 14 B. & S. gage wire that is protected by approved fuses. This circuit is not to carry over 660 watts.

For the protection of instruments and pilot lights on switchboards approved enclosed fuses of not over two ampere capacity may be used.

(3) Switchboards:

(*a*) Must be so placed as to reduce to a minimum the danger of communicating fire to adjacent combustible material.

Switchboards must not be built up to the ceiling, a space of three feet being left, if possible, between the ceiling and the board. The space back of the board must be kept clear of rubbish and must not be used for storage.

(*b*) Must be made of incombustible material.

(*c*) Must be accessible from all sides when the connections are on the back, but may be placed against a brick or stone wall when the wiring is entirely on the face.

If the wiring is on the back, there must be a clear space of at least eighteen inches between the wall and the apparatus on the board.

(*d*) Must be kept free from moisture.

(*e*) Insulated conductors where closely grouped as in rear of switchboards must each have a substantial flameproof outer covering.

Flameproofing must be stripped back on all conductors a sufficient distance from the terminals to give the necessary insulation for the voltage of the circuit on which the conductor is used.

(4) Resistance Devices:

(*For construction rules see Nos.* 78, 79 *and* 80.)

(*a*) Must be placed on a switchboard, or at a distance of at least one foot from combustible material, or separated therefrom by a slab or panel of incombustible, non-absorptive, insulating material such as slate, soapstone or marble somewhat larger than the rheostat, which must be secured in position independently of the rheostat supports. Bolts for supporting

(4) Resistance Devices—continued.

the rheostat shall be counter-sunk at least one-eighth inch below the surface at the back of the slab and the bolt heads shall be covered with insulating materials. For proper mechanical strength, slab should be of a thickness consistent with the size and weight of the rheostat, and in no case to be less than one-half inch.

If resistance devices are installed in rooms where dust or combustible flying would be liable to accumulate on them, they must be equipped with dust-proof face plates.

(*b*) Where protective resistance are necessary in connection with automatic rheostats, incandescent lamps may be used, provided that they do not carry or control the main current nor constitute the regulating resistance of the device.

When so used, lamps must be mounted in porcelain receptacles upon incombustible supports, and must be so arranged that they cannot have impressed upon them a voltage greater than that for which they are rated. They must in all cases be provided with name plate, which shall be permanently attached beside the porcelain receptacle or receptacles and stamped with wattage and voltage of the lamp or lamps to be used in each receptacle.

Under special authorization in writing, given in advance, incandescent lamps may be used for the purpose of resistance in series with other devices when mounted in porceleain receptacles upon incombustible supports, and so arranged that they cannot have impressed upon them a voltage greater than that for which they are rated.

(*c*) Wherever insulated wire is used for connection between resistance elements and the contact device of a rheostat, the insulation must be incombustible, or "slow burning." For large rheostats and similar resistances where the contact devices are not mounted upon them the connecting wires having "slow-burning" insulation may be so arranged in groups that the max-

(4) Resistance Devices—continued.

imum difference of potential between any two wires in any group shall not exceed seventy-five volts. Each group of wires must either be mounted on incombustible, non-absorptive insulators, giving at least one-half inch separation from surface wired over, or specially where it is necessary to protect same from mechanical injury, each group of wires may be encased in approved flexible tubing and placed in approved conduit, the flexible tubing to extend at least one inch beyond the ends of the conduit.

(5) Lighting Arresters:

(*a*) Must be attached to each wire of every overhead circuit connected with the station.

(*b*) Must be located in readily accessible places away from combustible materials, and as near as practicable to the point where the wires enter the building. In all cases, kinks, coils and sharp bends in the wires between the arresters and the outdoor lines must be avoided as far as possible.

(*c*) Must be well isolated from all other equipment and, if of the oil immersed type, must be located outside or in a fireproof room or compartment on the premises. Must be grounded as provided in No. 15A.

(*d*) All choke coils or other attachments, inherent to the lighting protection equipment, shall have an insulation from the ground or other conductors equal at least to the insulation demanded at other points of the circuit in the station.

(7) Ground Detectors:

All circuits except such as are permanently grounded as provided in No. 15A, must be provided with reliable ground detectors.

Detectors which indicate continuously and give an instant and permanent indication of a ground are preferable. Ground connection must be made as provided in No. 15A.

(8) Motors:

(*a*) All motors, including washing machines, except small portable motors under ¼ horse power must have their frames grounded in the manner specified in No. 15A.

(*b*) Motors operating at a potential of 550 volts or less must be wired with the same precautions as required by rules in Class "C" for wires carrying a current of the same volume.

Motors operating at a potential between 550 and 3,500 volts must, except in central or sub-stations, be wired with approved multiple conductor, metal sheathed cable in approved metal conduit. All apparatus and wiring connected to the high tension circuit must be completely enclosed in substantial metal shields or casings and the conduit must enter and be properly secured to such casing or suitable terminal boxes screwed or bolted to the casings. Shields, casings and conduit must be grounded as provided in No. 15A.

The insulation of the several conductors for high potential motors, where leaving the metal sheath of cables must be thoroughly protected from moisture and mechanical injury. This may be accomplished by means of a pot head or some equivalent method. The conduit must be substantially bonded to the metal casings of all fittings and apparatus connected to the inside high tension circuit. Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps.

Where motors operating at a potential between 550 and 3,500 volts are located in a special room or vault adjoining an outside wall and the conductors entering from the outside are not in conduit the conductors may be rigidly supported on glass or porcelain, insulators, which keep them at least one inch from the surface wired over, and not less than eight inches apart except at motor and devices.

(8) Motors—continued.

Conductors carrying the current of only one motor must be designed to carry a current at least 10 per cent. greater than that for which the motor is rated. Where the conductors under this rule would be overfused in order to provide for the starting current, as in the case of many of the alternating current motors, the conductors must be of such size as to be properly protected by these larger fuses.

To provide for the peak loads which are encountered in certain classes of service, such as those mentioned in the following table, without overfusing the conductors, motors will sometimes require cables considerably larger than those specified in the preceding paragraph. In the majority of cases the necessary requirements will be met if conductors are based on the following percentages of the name plate rating:

Percentages of name plate rating.

Classification of Service.	5 Min. Rating.	10 & 15 Min. Rating.	30 & 60 Min. Rating.	2 Hours Rating.	Continuous Rating.
Operating valves raising or lowering rolls.....	110	120	150	200	250
Rolling tables	110	120	135	180	200
Hoists, rolls, ore and coal-handling machines	110	115	120	150	170
Freight and passenger elevators, shop cranes, tool heads, pumps and similar apparatus	110	110	110	120	140

(*c*) Each motor with its starting device must be protected by an automatic overload protective device (fuses, thermal cutouts, overload relays or circuit breaker), and controlled by a switch (see No. 19 *a*), said switch plainly indicating whether "on" or "off" (except as provided for or permitted by No. 43 *c*). Small motors may be grouped under the protection of a single set of fuses, provided the rated capacity of the

(8) **Motors—continued.**

fuses does not exceed 10 amperes and the total wattage of the circuit does not exceed 660. With motors of one-fourth horse power or less, on circuits where the voltage does not exceed 300, single pole switches may be used as allowed in No. 24 (*c*). The switch and rheastat must be located within sight of the motor, except in cases where special permission to locate them elsewhere is given in writing by the Inspector of buildings.

Except for auto-starters the switch called for in the preceding paragraph may be omitted where the motor starter disconnects all wires of the circuit. When auto-starters are used a switch must be provided on the supply side of each auto-starter, or group of auto-starters. When an A. C. starter, when in running position, opens all wires of the circuit automatically under overload it may also serve as a circuit breaker. When the overload release device of a D. C. starter is inoperative during the process of starting the motor a separate circuit breaker or set of fuses must be provided.

An automatic circuit breaker disconnecting all wires of the circuit may also serve as a switch.

Where a rubber-covered conductor carries the current of only one A. C. motor of a type requiring large starting current it may be protected by a fuse or an automatic circuit breaker without time limit device, rated in accordance with Table B. of No. 18. The rated continuous current capacity of a time limit circuit breaker protecting a motor of the above type need not be greater than 110 per cent. of the motor current rating, providing the time limit device is capable of preventing the breaker opening during the starting perod.

Alternatng current motors operating freight or passenger elevators or cranes, that are dependent on phase relation for the direction of rotation, must be protected by approved automatic circuit breakers (or reverse phase relay) operative in the event of any

(8) Motors--continued.

phase reversal that would cause a reverse motor rotation, or in the event of the motor being connected to the line single phase.

Each motor must be protected by an automatic overload protective device. If a circuit breaker is used, one pole must be provided in each ungrounded conductor and the circuit breaker must be so designed that its operation will open all of the ungrounded conductors simultaneously except that for direct current and single phase alternating current motors, one single pole breaker may be used in each conductor or a single pole circuit breaker in one conductor and a fuse in the other. The number of overload trip coils, relays or thermal cutouts must not be less than shown in the following table:

System.	Number of Overload Trip Coils.
4 wire, 2 phase A. C.	2—1 in each phase in ungrounded wires.
3 wire, 2 phase A. C.	2—1 in each outside conductor.
3 wire, 3 phase A. C.	2—1 in each of 2 ungrounded wires.
2 wire, A. C. or D. C.	2—1 in each ungrounded conductor
2 wire, A. C. or D. C. grounded.	1 in the ungrounded conductor.

Except on main switchboard or when otherwise subject to competent supervision an approved fuse must be provided in each conductor of motor circuits whether an automatic overload circuit breaker is installed or not. Circuit breakers will be approved in lieu of fuses for circuits having a maximum capacity greater than that for which approved enclosed fuses are rated.

If an A. C. starter, when in the running position, opens all of the conductors of the circuit automatically under overload, and is equipped with the proper number of overload trip coils as given above it may also serve as a circuit breaker. If the overload releases device of a D. C. starter is inoperative during the

(8) Motors—continued.

process of starting the motor a separate circuit breaker or set of fuses must be provided.

(1) Each continuous rated motor of over 2 H. P. used for constant load duty must be protected by running fuses, thermal cut-outs or a circuit breaker in accordance with the following:

If fuses or thermal cut-outs are used their rated capacity must not exceed 125% of the name plate current rating of the motor except that when no fuses or thermal cut-outs of the required capacity exist, those of the next higher standard rating may be used. If a circuit breaker is used it should have a continuous current capacity of at least 110% of the name plate current rating of the motor. If the circuit breaker is of the time limit type it should have a setting of not over 125%. and of the instantaneous type a setting of not over 160% of the name plate current rating of the motor.

To comply with the above rule in the case of a squirrel cage or similar type motor having a large starting current it will be necessary to use a motor starter or double throw switch so designed that the protective device will be shunted or cut out of service during the starting period, unless a time limit circuit breaker or similar device is used which will prevent the opening of the circuit during the starting period. Where a double throw switch is used to shunt the motor protective device during the starting period it must be of such type that it will be held in off and running positions but cannot be left in the starting position.

(2) Continuous rated motors of 2 H. P. or less are considered as being sufficiently protected by the fuses or circuit breakers protecting the conductors of the motor circuits as required in the rules following the heading "Size and protection of conductors of motor circuits."

(8) Motors—continued.

(3) Motors of other than continuous rating or used on other than continuous load duty will be considered as being sufficiently protected by the fuses or circuit breakers used to protect the motor circuits.

Size and Protection of Conductors of Motor Circuits.

Conductors carrying the current of only one motor must have a carrying capacity of at least 110% of the name plate current rating of the motor, the actual size to be determined by the rating of the fuses or the seting of the circuit breaker protecting them.

Except as provided in the following paragraph, each ungrounded conductor carrying the current of only one motor or group of motors must be protected in accordance with the general requirements for the protection of conductors; that is, the rated capacity of the fuses must not exceed the carrying capacity of the conductors and circuit breakers must not be set more than 30% above the carrying capacity of the conductors as given in No. 18. Where rubber covered or varnished cambric covered wire is used in a branch circuit carrying the current of only one A. C. motor of a type having large starting current and this circuit is protected by fuses it may be protected in accordance with Table C. of No. 18, but in no case should a rubber covered or varnished cambric covered conductor in a branch circuit carrying the current of only one motor have a carrying capacity in accordance with Tables A and B respectively less than 110% over and above of the name plate current rating of the motor.

Automatic overload protective devices may be omitted at the point where conductors carrying the current of only one motor are connected to the mains, provided their current carrying capacity is at least one-third that of the mains, the length of the conductors between the mains, and the motor protective devices is not greater than 15 feet and they are suitably protected from mechanical injury.

Rated full load current.	Percentage.
0 to 30 amperes	250
Above 30 amperes	250

(8) **Motors—continued.**

(*d*) Rheostats must be so installed as to comply with all the requirements of No. 4. Auto starters must comply with requirements of No. 4 (*c*).

Where there is any liability of short circuits across the exposed live parts of an auto starter by accidental contacts, a railing must be erected around them.

(*e*) Must not be run in series multiple or multiple-series except on constant potential systems. Departure from this rule may be authorized only under special permission in writing from the Inspector of Buildings.

(*f*) Motors having brushes or sliding contacts exposed to combustible dust must be placed in separate dust-tight room, or non-combustible housing provided with effective ventilation from a source of clean air.

In places where combustible dust is thrown into suspension in the air in sufficient quantity to produce explosive mixtures, such as in flour mills, grain elevators, etc., or where it is impracticable to prevent dust or flying material collecting in dangerous quantities on or in motors, all motors shall be either of the totally enclosed type or shall be placed in separate dust-tight rooms or non-combustible housings. Such rooms or housings shall be effectively ventilated from a source of clean air.

Motors permanently located on wooden floors must be provided with suitable drip pans.

(*g*) Must each be provided with a name plate, giving the maker's name, the capacity in volts and amperes, the normal full load, speed, and the interval during which they can safely operate, starting cold. The time interval given must either be 5, 10, 15, 30, 60 or 120 minutes, or continuous. This does not apply to motors for railway service.

(*h*) Terminal blocks when used on motors must be made of approved incombustible, non-absorptive, insulating material such as slate, marble or porcelain.

(8) Motors—continued.

(*i*) Adjustible speed motors, unless of special and appropriate design, if controlled by means of field regulations, must be so arranged and connected that they cannot be started under weakened field.

(*j*) The use of soft rubber bushings to protect the lead wires coming through the frames of motors is permitted, except when installed where oils, grease, oily vapors or other substances known to have rapid deleterious effect on rubber are present in such quantities and in such proximity to motors as may cause such bushings to be liable to rapid destruction. In such cases hardwood properly filled, or preferably porcelain or micanite bushings must be used.

(9) Feeder Protection:

Each constant potential circuit entering or leaving a supply station, except grounded rail return conductors of railway power plants or grounded neutral conductors of three-wire systems, must be protected from excessive current by an approved automatic overload circuit breaker or by an equivalent device of approved design. Such protective devices must be located as near as practicable to point where conductors enter or leave the building. For outgoing circuits not connected with other sources of power, however, the protective devices must be placed on the supply-side of transformers or similar devices.

Oil circuit-breakers and switches must, wherever practicable, be isolated from other switches and electrical apparatus. On circuits of over 7,500 volts they must be of the remote control type and be enclosed in separate fireproof cells or compartments.

(10) Storage or Primary Batteries:

(*a*) When current for light and power is taken from primary or secondary batteries, the same general regulations must be observed as apply to similar apparatus fed from generators, developing the same difference of potential.

(10) Storage or Primary Batteries—continued.

(*b*) Storage battery rooms must be thoroughly ventilated.

(*c*) In all rooms where acid fumes exist wiring must be done as required in Rule No. 26 (*i*).

(*d*) All secondary batteries must be mounted on non-absorptive, incombustible insulators, such as glass or thoroughly vitrified and glazed porcelain.

(*e*) The use of any metal liable to corrosion must be avoided in cell connections of secondary batteries.

(11) Transformers:

(*See also Nos.* 36 *and* 45. *For construction rules see No.* 81.)

(*a*) In central or sub-stations, transformers of oil cooled type must always be placed in incombustible buildings or structures. Said buildings or structures must be furnished with a floor drain to carry the oil away or else with incombustible sill, dams, sumps, or other equivalent means for preventing the spread of oil. In central or sub-stations transformers of the air-cooled type must be isolated from all other equipment as required for oil cooled transformers, and wherever air-blast cooling is used the air must be supplied through fireproof flues or ducts.

In central and sub-stations, casings of transformers must be grounded as provided in No. 15A.

(*b*) The cases or frames of transformers used exclusively to supply current to switchboard instruments must be grounded as provided in No. 15A, unless they are installed and guarded in all respects as required for the higher voltage circuit connected to them.

(12) Service Wiring:

(*a*) Service wires must have an approved weather-proof or rubber insulating covering, except that serv-

(12) Service Wiring—continued.

ices of multiple-conductor cable from pole to building must in all cases have an approved rubber insulating covering.

Service cut-out and switch must be placed on all service wires, either overhead or underground, in the nearest readily accessible place to the point where the wires enter the building, and arranged to cut off the entire current. The service wires between the main cut-out and service loop on the outside of building shall not be smaller than No. 10 B. & S. gage, and shall have an approved rubber insulating covering. The service wires must be brought into the building in standard iron conduit. The conduit system must be waterproof and must be placed on the outside of the building wall. The conduit must be equipped with a standard service head and fittings and so placed that water cannot enter the fitting or conduit. There must be no splices in the service wires between the service cut-out and the point of connection with the wires from the pole.

(*b*) Line and service wires shall be so placed that moisture cannot form a cross connection between them, and shall not be in contact with anything but their supports. They shall be not less than one foot apart except when in conduit or multiple-conductor cable or on approved racks or brackets.

On exterior walls of buildings, services of multiple-conductor cable and all service wires liable to come in contact with awnings, swinging signs, shutters or other movable objects must be enclosed in approved conduit.

(*c*) Wires exposed to the weather must be supported on petticoat insulators, except that, on low-potential systems, approved wiring brackets, racks, supports or insulators may be used.

Wires on the exterior walls of buildings must be supported at least every 15 feet, the distance between supports to be shortened if wires are liable to be disturbed.

(12) Service Wiring—continued.

(*d*) With approved racks or brackets a spacing of six inches between wires will be permitted if supports are not more than 9 feet apart, wires are kept taut and so mounted as not to come into contact with each other or with the building or other object. Wires must be kept at least two inches from the surface wired over.

(*e*) All service conduit shall be electrically connected to service switch box, and must be separately grounded to water piping. The conductors entering buildings from overhead lines must be encased in approved rigid metal conduit having weather-proof threaded joints, equipped with approved service head, and all wires of same circuit shall be in same conduit (*see No.* 28 (*i*), *Table* 1, *for number and size of conductors permitted in service conduit*).

(13) Feeds or Branch Circuits:

(*f*) A cut-out shall be installed in an iron box near the Electric Co.'s meter to protect the feeder or branch circuits leading from same. Wires shall be left long enough to connect to the Electric Co.'s service box and meter, and shall not be smaller than the service wires.

(*g*) Where wires enter cabinets, cut-out boxes or junction boxes, they shall be fitted with approved conduit, metal moulding or approved bushing, as no circular loom will be permitted for protection of wires entering such boxes.

All fuse blocks regardless of type or system must be installed in an approved metal box placed in a vertical position, and the door shall be such as to close by gravity or a spring to hold it shut.

CLASS C.

REQUIREMENTS FOR INSIDE WORK.

(Including All Work for Light, Power and Heat, Protected by Service Cut-out and Switch. For Signaling Systems see Class E.)

ALL SYSTEMS AND VOLTAGES.

GENERAL RULES.

(15A) Method of Grounding, when Protective Grounding is Required:

(*What to ground see Nos.* 1 *c*, 1 *d*, 5 *c*, 7 *a*, 8 *a*, *b*, 11 *b*, 25 *c*, 27 *c*, 28 *f*, 29 *e*, 43 *e*, 45 *c*, 86 *b*.)
(*a*) General Provisions:

Where low potential circuits are grounded under the following rules, circuits must be so arranged that under normal conditions of service there will be no appreciable passage of current over the ground conductor.

(*a*) When arresters, equipment, wire race-ways, and similar devices are grounded under the following rules, ground connections must be so arranged that under normal conditions of service there will be no appreciable passage of current over the grounding conductor.

Direct Current Systems. Point of Attachment.

(*b*) In three-wire direct-current systems the ground connection must be made on the neutral and at one or more supply stations, but not at individual services or within building served.

(*c*) In two-wire direct-current systems the ground connection must be at one station only.

(15A) Method of Grounding—continued.

Alternating-Current Systems. Point of Attachment.

(*d*) The connection with the ground for alternating current systems shall be made at each service, building or near the transformer (or transformers) either by direct ground connection through water piping system or artificial ground system. The resistance and current-carrying requirements for Ground Conductors Section (*k*) and Ground Connection Section (*t*).

Where the secondaries of transformers are supplying a common set of mains, fuses if installed must be installed only at such points as will not cause the loss of the ground connections after any fuses in the transformer circuit or mains have been blown.

Multiple grounds are preferable in most cases, but grounds, other than the single ground connections at the building service must not be made to alternating current secondaries within the building served.

(*e*) In single phase, three-wire systems, the ground must be on the neutral conductors.

(*f*) In single phase, two-wire systems, the ground may be on either of the conductors.

(*g*) In two-wire single phase, and in two or three phase systems, the ground must be connected at that point of the system which brings about the lowest voltage from ground of unguarded current carrying parts of connected devices and also permits of most convenient grounding. Where any phase of a two or three phase system is used for lighting, that phase must be grounded and at the neutral conductor, if one is used.

(*h*) For lighting arresters the grounding conductor shall be as short and as straight as practicable.

(*i*) For generators, motors, transformers, conduit, armored cable, metal race-ways and the like, the point at which the grounding conductor is attached must, if practicable, be readily accessible.

(15A) Method of Grounding—continued.

For conduit, armored cable and metal race-ways, the grounding conductor must be attached as near as practicable to the point where the conductor in the system concerned receives its supply.

Where the service conduit is grounded its grounding conductor must be run direct from it and no portion of the interior conduit is to be used as a part of the grounding conductor.

Ground Conductors:

(*j*) In all cases, the ground conductor must be of copper or of other metal which will not corrode excessively under the existing conditions, and if practicable must be without joint or splice. In no case shall an automatic cut-out be inserted in a ground conductor or connection, except in ground conductors for equipment where its operation will disconnect all leads connected to the equipment from the circuit conductors.

The insulation and installation of the ground conductor for circuits must comply with all the requirements of this Code for wires of the voltage of the circuit to which the ground conductor is attached. In all cases the ground conductor must be protected against mechanical injury. Protection for lightning arrester ground conductors must be of non-magnetic material unless the ground conductor is electrically connected to both ends of the protective device. The ground conductor for equipment or wire race-ways must not be connected to a circuit ground conductor or a grounded circuit conductor.

(*k*) The grounding conductor or conductors for circuits must, in general, have combined current capacity sufficient to insure the continuity and continued effectiveness of the ground connection under conditions of excess current caused by accidental grounding of any normally ungrounded conductor of the circuit.

(15A) Method of Grounding—continued.

The grounding conductor for a three-wire direct-current system must have a combined current capacity not smaller than the neutral wire to which it is attached.

The grounding conductor for alternating current systems must not be smaller than No. 8 copper wire, nor smaller than one-fifth the current capacity of the wire to which it is attached, except that it need not be larger than No. 0 copper wire.

Lightning arrester ground connections must not be made to the same artificial ground (driven pipes or buried plates) as circuits or equipment, but must be well spaced and when practicable kept at least 20 feet from other artificial grounds.

(*l*) For lightning arresters the grounding conductor must have a current capacity sufficient to insure the continuity and continued effectiveness of the ground connection under conditions of excess current caused by or following discharge of arrester.

No individual grounding conductor shall have a smaller current capacity than No. 6 B. & S. gage copper wire.

(*m*) For the frames of electrical equipment the current capacity of the grounding conductor must not be less than that provided by copper wire of the size indicated in the following table.

For portable equipment protected by fuses not greater than 15 amperes, No. 10 B. & S. gage wire must be used for grounding the frames.

For portable equipment using more than 15 amperes the requirements of the following table must be followed.

Grounding conductor must not be less than that provided by copper wire of the size indicated in the following table.

(15A) Method of Grounding—continued.

Capacity of nearest cut-out protecting the equipment.	Required size of ground conductor.
0 to 100 amperes	No. 10 B. & S. gage
101 to 200 amperes	No. 6 B. & S. gage
201 to 500 amperes	No. 4 B. & S. gage
501 amperes and above	No. 2 B. & S. gage

The grounded circuit wires must not be used as ground wire for equipment and devices and ground conductors from equipment and devices must not be connected to grounded circuit wires.

(*mm*) Switchboard Instruments. Where meters and instruments are used with current and potential transformers, the cases of the meters and instruments may be connected to the grounded water piping grounded for the purpose of avoiding errors due to electrostatic action in which case No. 10 B. & S. gage copper wire or larger shall be used for the grounding conductor.

(*n*) If an armored cable system, a conduit system or a metal race-way system, consist of several separate sections, the sections must be bonded to each other, and the system grounded, or each section may be separately grounded.

The armor of conduits, cables, metal raceways and gas pipes must either be securely fastened in outlet boxes, junction boxes and cabinets, so as to secure good electrical connection or the separate sections, boxes and cabinets must be separately grounded.

Where isolated runs of armored cable, conduit or metal race-ways not over 25 feet long are used for the protection of wires on side walls and such conduit or pipe and wiring is installed as required in No. 26 (*e*), the conduit or pipe need not be grounded.

The grounding conductor for armored cable, conduit or metal race-way must be at least equivalent to No. 10 B. & S. gage copper, etc.—and for service conduit the grounding conductor shall not be less than No. 10 B. & S. gage copper.

(15A) Method of Grounding—continued.

Ground wires must be of copper or other metal which will not corrode excessively under the existing conditions. They must be at least equivalent to No. 10 B. & S. gage copper (where the largest wire contained is greater than No. 0 B. & S. gage), and for service conduit the ground shall not be less than No. 6 B. & S. gage copper.

The grounded circuit wires must not be used as ground wire for conduits, cables, metal race-ways and ground conductors from conduits, cables and metal race-ways must not be connected to ground circuit wires.

If conduit, couplings or fittings having protective coating of non-conducting material, such as enamel, are used, such coating must be thoroughly removed from threads of both couplings and conduit and such surfaces or fittings where the conduit or ground clamp is secured, in order to obtain the requisite good connection. Grounded pipes must be clean of rust, scale, etc., at the place of attachment of ground clamp.

(o) **Ground Connection:**

The connection and contact with the ground shall be permanent and effective and shall be made as indicated below but always to a water piping system if available.

For circuits, equipment and arresters at supply stations, the connections must be made to all available active, continuous, metallic underground water piping systems between which no appreciable difference of potential normally exists and to one system only if appreciable differences of potential do exist between them. At other places connections shall be made to at least one such system if available.

Where underground metallic piping systems are not available, other methods which will secure the desired permanence and conductance shall be used.

(15A) Method of Grounding—continued.

(*p*) Protective ground connections must not be made to grounded conductors or rails of electric railway circuits when other effective means of grounding are available that lightning arresters, equipment and metal raceways must not be made to railway negative return circuits when other effective means of grounding are available.

(*q*) Ground connections to underground metallic piping system should preferably be made on the street side of water meters but connections for equipment, conduit, metal race-ways, armored cable, and for multiple grounds of alternating current secondaries may be made to the water piping system near the part to be protected. In such cases, where parts of the water piping system are liable to be physically disconnected, such as at meters, a shunt consisting of two approved clamps and conductor of same size as the grounding conductor shall be used to keep the connection with the underground piping system continuous and permanent.

Gas piping systems within buildings shall not be used for grounding.

When the making of a ground to a piping system outside meter or other device would involve a long run, connection for equipment or wire runways may be made to the water piping system at a point near the part to be protected, provided there are no insulating joints in the pipe to prevent a good ground. In such cases care should be taken to electrically connect all parts of the piping system liable to create a hazard and to shunt the pipe system where necessary around meters and similar devices, in order to keep the connections with the underground piping system continuous.

The grounding conductors must be installed in approved conduit, metal or wooden moulding.

(15A) Method of Grounding—continued.

(*r*) The ground connection to pipes or rods must be made either: (1) by the use of an approved ground clamp bolted to the pipe or rod after it has been cleaned of all rust, scale, paint, etc., or (2) by screwing tightly into the pipe, pipe fittings, or rod a brass plug having a lug for the grounding conductor or (3) by other equivalent means. The wrapping of several turns of wire around the pipe or rod even if soldered is not approved. The grounding wire must be attached to the clamp or to the plug by means of solder or by an approved solderless connector. The point of connection should, preferably, be in plain sight and readily accessible.

(*s*) Where buried plates, driven pipes or driven rods are used for grounds they shall be embedded, where practicable, below the permanent moisture level. The total area of each ground shall present not less than two square feet surface to exterior soil but additional area will generally be necessary, to meet the provisions of Section (*t*).

Where copper ground plates are used they shall be at least .06 inch in thickness; where iron plates are used they shall be at least ¼ inch in thickness; where iron or steel pipes are used they shall not be smaller than ¾ inch outside diameter nor less than 8 feet in length. Where approved copper clad steel rods are used they shall not be less than ½ inch in diameter, not less than 8 feet in length.

(*t*) The combined resistance of the grounding wire and the connection with the ground for circuits, for equipment, or for lightning arresters should not exceed 3 ohms for water pipe connections or 25 ohms for buried or driven grounds where these must be used. Where, because of dry or other high resistance soils, it is impracticable to obtain artificial ground resistance as low as 25 ohms, with one ground with an area of two square feet, two such grounds with an area of four square feet and located at least six feet apart must be installed and no requirement will be made as to resistance.

(16) Wires:

(*See also Nos.* 17, 18, 20, 26, 27, 44, 47 *and* 48. *For construction rules see Nos.* 49 *to* 57.)

(*a*) Must not be of smaller size than No. 14 B. & S. gage except as allowed for fixture work and pendant cord.

(*b*) Knobs or cleats which are arranged to grip the wire must be fastened by either screws or nails. If nails are used, they must be long enough to penetrate the woodwork not less than one-half the length of the knob and fully the thickness of the cleat, and must be provided with washers which will prevent under reasonable usage, injury to the knobs or cleats.

(*c*) Wires must be so spliced or jointed as to be both mechanically and electrically secure without solder. The joints must then be soldered unless made with some form of approved splicing device, and covered with an insulation equal to that on the conductors.

Stranded wires (except in flexible cords) must be soldered before being fastened under clamps or binding screws, and whether stranded or solid, when they have a conductivity greater than that of No. 8 B. & S. gage they must be soldered into lugs for all terminal connections, except where an approved solderless terminal connector is used.

(*d*) Must be separated from contact with walls, floors, timbers or partitions through which they may pass by incombustible, non-absorptive, insulating tubes, such as glass or porcelain, except at outlets where approved flexible tubing is required.

Bushings must be long enough to bush the entire length of the hole in one continuous piece, or else the hole must first be bushed by a continuous waterproof tube. This tube may be a conductor, such as iron pipe, but in that case an insulating bushing must be pushed into each end of it, extending far enough to keep the wire absolutely out of contact with the pipe.

(16) Wires—continued.

(*e*) Where not enclosed in approved conduit, raceways or armored cable, and where liable to come in contact with gas, water, or other metallic piping or other conducting material, must be separated therefrom by some continuous and firmly fixed non-conductor creating a permanent separation. Must not come near than two (2) inches to any other electric lighting power or signalling wire, not enclosed as above, without being permanently separated therefrom by some continuous and firmly fixed non-conductor. The non-conductor used as a separator must be in addition to the regular insulation on the wires. Where tubes are used, they must be securely fastened at the ends to prevent them from moving along the wire.

(*f*) Must be so placed in wet places that an air space will be left between conductors and pipes in crossing, and the former must be run in such a way that they cannot come in contact with the pipe accidentally. Wires should be run over, rather than under, pipes upon which moisture is likely to gather or which, by leaking, might cause trouble on a circuit.

(*g*) The installation of electrical conductors in raceways or on insulators, in elevator shafts will not be approved, but conductors may be installed in such shafts if encased in metal conduits.

(*h*) In three-wire (not three-phase) systems, the neutral must be of sufficient capacity to carry the maximum current to which it may be subjected.

(17) Underground Conductors:

(*a*) Must be protected against moisture and mechanical injury where brought into a building and all combustible material must be kept from the immediate vicinity.

(*b*) Must not be so arranged as to shunt the current through a building around any junction box.

(17) Underground Conductors

(*c*) Where underground service enters building through tubes, the tubes shall be tightly closed at outlets with asphaltum or other non-conductor to prevent gases from entering the building through such channels.

(*d*) No underground service from a subway to a building and no service from a private generating plant shall supply more than one building, unless the conductors are properly protected by fuses and are carried outside all the buildings but the one served. Conductors in conduit or duct under two inches of concrete under a building, or buried back of two inches of concrete or brick within a wall are considered as lying outside of the building. These requirements do not apply to factory yards and factory buildings under single occupancy or management.

(18) Table of Allowable Carrying Capacity of Wires:

(*For construction rules see Nos.* 49 *to* 57.)

(*a*) Conductors may be placed in multiple only by special permission of the Inspector of buildings.

(*b*) The following table, showing the allowable carrying capacity of copper wires and cables of ninety-eight per cent. conductivity, according to the standard adopted by the American Institute of Electrical Engineers, must be followed in placing interior conductors.

For insulated aluminum wire the safe carrying capacity is eighty-four per cent. of that given in the following table for copper wire with the same kind of insulation.

TABLE I. ALLOWABLE CARRYING CAPACITIES OF WIRES.

B. & S. Gage.	Diameter of Solid Wires in Mils.	Area in Circular Mils.	Table A Rubber Insulation Amperes	Table B Varnished Cloth Insulation Amperes	Table C Other Insulation Amperes
18	40.3	1,624	3		5
16	50.8	2,583	6		10
14	64.1	4,107	15	18	20
12	80.8	6,530	20	25	25
10	101.9	10,380	25	30	30
8	128.5	16,510	35	40	50
6	162.0	26,250	50	60	70
5	181.9	33,100	55	65	80
4	204.3	41,740	70	85	90
3	229.4	52,630	80	95	100
2	257.6	66,370	90	110	125
1	289.3	83,690	100	120	150
0	325.	105,500	125	150	200
00	364.8	133,100	150	180	225
000	409.6	167,800	175	210	275
		200,000	200	240	300
0000	460.	211,600	225	270	325
		250,000	250	300	350
Varnished cloth insulated wires smaller than No. 6 may be used for leads on motors, generators, oil-filled transformers, auto starters, oil switches and other apparatus where oil may come in contact with the insulation, and when such leads are furnished as part of the device.		300,000	275	330	400
		350,000	300	360	450
		400,000	325	390	500
		500,000	400	480	600
		600,000	450	540	680
		700,000	500	600	760
		800,000	550	660	840
		900,000	600	720	920
		1,000,000	650	780	1,000
		1,100,000	690	830	1,080
		1,200,000	730	880	1,150
		1,300,000	770	920	1,220
		1,400,000	810	970	1,290
		1,500,000	850	1,020	1,360
		1,600,000	890	1,070	1,430
		1,700,000	930	1,120	1,490
		1,800,000	970	1,160	1,550
		1,900,000	1,010	1,210	1,610
		2,000,000	1,050	1,260	1,670

In other cases, varnished cloth insulated wires smaller than No. 6 may be used only by special permission.

TABLE II. STANDARDIZED STRANDING.

Strands.			Cable.		Allowable Carrying Capacities in Amperes.		
No. of Strands.	Mils. Dia.	B. & S. Gage No.	Area in Cir Mils.	Outside Dia. over Copper.	Table A Rubber Insulation.	Table B Varnished Cloth Insulation.	Table C Other Insulation.
7/ 25		22	4,390	.075	15	18	20
7/ 32		20	7,150	.096	20	25	25
7/ 40		18	11,370	.120	25	30	35
7/ 51		16	18,080	.153	35	40	50
7/ 64		14	28,740	.192	50	60	70
7/ 81		12	45,710	.253	70	85	90
7/ 91		11	58,000	.273	80	95	110
7/102		10	72,680	.306	90	110	130
19/ 64		14	78,030	.320	100	120	150
19/ 72		13	98,380	.360	125	150	175
19/ 81		12	124,900	.405	150	180	210
19/ 91		11	157,300	.455	175	210	250
19/107		*	217,500	.540	225	270	325
19/114		9	248,700	.570	250	300	350
37/ 91		11	306,400	.637	275	330	400
37/ 97		*	347,500	.679	300	360	450
37/102		10	381,200	.714	325	390	500
37/116		*	484,300	.798	400	480	600
61/102		10	633,300	.918	475	565	700
61/107		*	698,000	.963	500	600	750
61/114		9	788,500	1.030	550	660	825
61/121		*	893,100	1.090	600	720	900
61/128		8	1,007,000	1.150	650	780	1,000
91/114		9	1,191,000	1.250	725	870	1,125
91/128		8	1,502,000	1.410	850	1,020	1,350
127/114		9	1,660,000	1.480	900	1,100	1,460
127/128		8	2,097,000	1.660	1,100	1,300	1,700

*These individual strands are odd sizes not listed in the American or B. & S. Wire Tables.

(19) Switches, Cut-outs, Circuit-breakers, Etc.:

(*a*) On constant potential circuits. all service switches and all switches controlling circuits supplying current to motors or heating devices and all fuses, unless otherwise provided (for exceptions as to switches see Nos. 8 (*c*), 24 (*a*) and (*c*), 25 (*a*) and 43 (*c*); for exceptions as to cut-outs see Nos. 23 (*a*) and (*b*) and 43 (*c*), must be so arranged that the fuses will protect, and the opening of the switch will disconnect all of the ungrounded wires.

(19) Switches, Cut-outs, Circuit-breakers, Etc.—continued.

(*b*) Must be so arranged that the fuses will protect and the opening of the switch will disconnect all the wires, that is, in the two-wire system the two wires, and the three-wire system the three wires, must be protected by the fuses and disconnected by the operation of the switch.

When installed without other automatic over-load protective devices automatic over-load circuit breakers must have the poles and trip coils so arranged as to afford complete protection against over-loads and short circuits. In two or three-phase three-wire circuits and two-phase four-wire circuits there must be a trip-coil in each of the two phases and in four-wire three-phase circuits there must be a trip-coil in each phase.

If a circuit breaker is also used in place of the switch it must be so arranged that no one pole can be opened manually without disconnecting all wires.

The above rules do not apply to grounded return circuits of electric railway systems.

(*b*) Must not be placed where exposed to mechanical injury or in the immediate vicinity of easily ignitable materials or where exposed to inflammable gases or dust or flying or combustible material. Where the occupancy of the building is such that switches, cut-outs, and similar devices cannot be located so as not to be exposed as above, they must be mounted in approved cut-out boxes or cabinets, except oil switches, circuit-breakers and similar devices which have approved casings.

Cabinets and cut-out boxes must be of metal when used with metal conduits; armored cable or metal raceway systems; for exception see Nos. 40 (*c*) and 41 (*e*).

(*c*) Must, when located where exposed to moisture as in basements and similar places, be mounted in approved cut-out boxes or cabinets, and, when located in wet places or outside of buildings, must be mounted in approved weather-proof cut-out boxes or cabinets.

(19) Switches, Cut-outs, Circuit-breakers, Etc.—continued.

(*d*) Time switches, sign flashers and similar appliances must be of approved design and enclosed in approved cabinets, except sign flashers mounted as described in No. 83 (*b*).

(*e*) Must have the spacing within cabinets or cut-out boxes between the walls of the cabinet or cut-out box and current carrying parts of devices as specified in No. 70.

System.	Number of Overhead Trip Coils.
4 wire, 3 phase A. C.	3—(1 in each phase)
4 wire, 2 phase A. C.	2—(1 in each phase in ungrounded wire)
3 wire, 3 phase A. C.	2—(1 in each of 2 ungrounded wires)
3 wire, 2 phase A. C.	2—(in each outside conductor)
3 wire, 1 phase A. C.	2—(1 in each outside conductor)
3 wire, D. C.	2—(1 in each outside conductor)
2 wire, A.C. or D. C. ungrounded	1
2 wire, A. C. or D. C. grounded	1—(in the ungrounded conductor)

CONSTANT-CURRENT SYSTEMS.

PRINCIPALLY SERIES ARC-LIGHTING.

Constant current systems will not be allowed inside buildings except by special permission.

(20) Wires:

(*See also Nos.* 16, 17, 18 *and* 44. *For construction rules see Nos.* 49 *and* 50.)

(*a*) Must have an approved rubber insulating covering.

(*b*) Must be arranged to enter and leave the building through an approved double-contact service switch, mounted in an incombustible case, kept free from moisture, and easy of access to police or firemen.

Switches must close the main circuit and disconnect the branch wires when turned "off"; must be so constructed that they shall be automatic in action, not stopping between points when started. and must prevent an arc between the points under all circumstances.

They must indicate whether the current be "on" or "off."

(*c*) Must always be in plain sight and never encased except when required by the Inspector of Buildings.

(*d*) Must be supported on glass or porcelain insulators, which separate the wire at least one inch from the surface wired over and must be kept rigidly at least eight inches from each other, except within the structure of lamps, on hanger-boards or in cut-out boxes, or like places where a less distance is necessary.

(*e*) Must, on side walls, be protected from mechanical injury by a substantial boxing, retaining an air space of one inch around the conductors, closed at the top (the wires passing through bushed holes) and ex-

(20) Wires—continued.

tending not less than seven feet from the floor. When crossing floor timbers in cellars or in rooms where they might be exposed to injury, wires must be attached by their insulating supports to the under side of a wooden strip not less than one-half an inch in thickness. Instead of the running boards, guard strips on each side of and close to the wires will be permitted.

These strips to be not less than seven-eighths of an inch in thickness and at least as high as the insulators.

(21) Series Arc Lamps:

(a) Must be provided at all times with a glass globe surrounding the arc, and securely fastened upon a closed base. Broken or cracked globes will not be permitted.

(*c*) Must be provided with a wire netting (having a mesh not exceeding one and one-fourth inches) around the globe and an approved spark arrester, when readily inflammable material is in the vicinity of the lamps, to prevent escape of sparks or carbon or melted copper.

Outside arc lamps must be suspended at least eight feet above sidewalks. Inside arc lamps must be placed out of reach or suitably protected.

Arc lamps when used in places where they are exposed to flyings of easily inflammable materials, must have the carbons enclosed completely in a tight globe in such manner as to avoid the necessity for spark arresters.

"Enclosed arc" lamps, having tight inner globes, may be used, and the requirements of Sections (*b*) and (*c*) above would not apply.

(*d*) Where hanger-boards are not used, lamps must be hung from insulating supports other than their conductors.

(21) Series Arc Lamps—continued.

(*e*) Lamps, when arranged to be raised and lowered either for carboning or other purposes, shall be connected up with stranded conductors from the last point of support to the lamp, when such conductor is larger than No. 14 B. & S. gage.

(22) Incandescent Lamps in Series Circuits:

(*a*) Must have the conductors installed as required in No. 20, and each lamp must be provided with an automatic cut-out.

(*b*) Must have each lamp suspended from a hanger-board by means of rigid tube.

(*c*) No electro-magnetic device for switches and no multiple-series or series-multiple system of lighting will be approved.

(*d*) Must not under any circumstances be attached to gas fixtures.

CONSTANT-POTENTIAL SYSTEMS.

GENERAL RULES—ALL VOLTAGES.

(23) Automatic Cut-outs (Fuses and Circuit-breakers):

(*See also No.* 19. *For construction rules see Nos.* 66 *and* 67.)

(*a*) Must be placed in all underground service wires, either overhead or underground, in the nearest accessible place to the point where they enter the buildings and inside the walls, and arranged to cut off the entire current from the building.

Departure from this rule as to location may be authorized only under special permission in writing by the Inspector of Buildings.

Where service switch, service fuses and meter are combined in an approved self-contained device or compact combination of such devices having no exposed wiring or live parts and no parts unprotected by fuses, except potential coils of the meter, such potential coils may be connected on the supply side of the service fuses.

In installations having private plants, the yard wires running from building to building are not considered as service wires, so that cut-outs would not be required where the wires enter buildings, provided that the next fuse back is small enough to properly protect the wires inside the building in question.

(*b*) Must be placed at every point where a change is made in the size of wire (unless the cut-out in the larger wire will protect the smaller—see No. 18).

Must not be placed in any permanently grounded wire, except as called for in Section (*d*).

(*c*) Must be in plain sight, or enclosed in an approved cabinet, and readily accessible. They must not be placed in the canopies or shells of fixtures.

(23) Automatic Cut-outs—continued.

Link fuses may be used only on switch-boards and must be mounted in approved cut-out boxes or cabinets. A space of at least two inches must be provided between the open-link fuses and metal or metal lined walls or metal, metal lined, or glass paneled doors of cabinet or cut-out boxes.

Must be so placed that no set of small motors, small heating devices or incandescent lamps, whether grouped on one fixture or on several fixtures or pendants (nor more than 13 medium size or 25 candelabra size sockets or lamp receptacles) requiring more than 660 watts, will be dependent upon one cut-out.

In cases where wiring equal in size and insulation to No. 14 B. & S. gage approved rubber covered wire is carried direct into keyless sockets or receptacles and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1200 watts (or 24 sockets or receptacles) will be dependent upon the final cut-out.

Except for signs and outline lighting, receptacles for attachment plugs, sockets and lamp receptacles will be considered as requiring not less than 40 watts each if of the medium size or 25 watts each if of the candelabra size.

All branches or taps from any threewire system which are directly connected to lamp sockets or other translating devices must be run as two-wire circuits which are directly connected to lamp sockets or other translating devices must be protected by proper fuses.

The fuses in the branch cut-out protecting circuit of 660 watts or less shall not have a rated capacity greater than that given in the following table:

15 amperes.....at 125 volts or less
10 amperes.....at 126 to 250 volts

(23) Automatic Cut-outs—continued.

(*d*) Fixture wire or flexible cord of No. 18 or No. 16 gage shall be considered as properly protected by 15 amperes fuses. Receptacles for attachment plugs (convenience outlets) are strongly recommended in order to facilitate the use of electrical appliances which, otherwise, must be connected to sockets designed primarily only as lamp holders. On a two-wire branch circuit and on either side of a three-wire branch circuit, the number of outlets shall not exceed twelve (12) except by special permission.

For the purpose of this section the term "branch circuits" and "outlets" are defined as follows:

"Branch Circuit" is that portion of a wiring system extending beyond the final set of fuses or circuit breakers protecting it, and at points on which current is taken to supply fixtures, lamps, heaters, motors and current consuming devices generally such points are designated as "outlets."

Branch circuits supplying only sockets or receptacles of the Mogul type shall have the wires protected by fuses having a rated capacity not greater than—

40 amperes.....at 125 volts or less
20 amperes.....at 126 to 250 volts

The number of Mogul sockets on a 2-wire branch circuit and on either side of a 3-wire branch circuit shall not exceed eight (8) except by special permission.

(*e*) The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 18. Circuit breakers must not be set more than 30 per cent. above allowable carrying capacity of the wire, unless a fusible cut-out is also installed on the circuit. Where a rubber-covered conductor carries the current of only one A. C. motor of a type requiring large starting current, it may be protected by a fuse or an automatic circuit breaker without time limit device, rated in accordance with Table B of No. 18. The rated continuous current capacity of the time limit

(23) Automatic Cut-outs—continued.

circuit breaker protecting a motor of the above type need not be greater than 110 per cent. of the motor current rating, provided the time limit device is capable of preventing the breaker opening during the starting period.

For the protection of wires having safe carrying capacities exceeding the rated capacity of the largest approved enclosed type fuses, approved enclosed fuses arranged in multiple may be used, provided as few fuses as possible are used and the fuses are of equal capacity and provided the cutout terminals are mounted on a single continuous pair of substantial bus bars. The total capacity of the fuses should not exceed the safe carrying capacity of the wires. This does not apply to motor circuits.

(*f*) Each conductor of motor circuits, except on main switchboard or when otherwise subject to competent supervision, must be protected by an approved fuse, whether automatic overload circuit breakers are installed or not. Single phase motors may have one side protected by an approved automatic overload circuit breaker only, if the other side is protected by an approved fuse.

(24) Switches:

(*See No.* 19. *For construction of switches see No.* 65.)

(*a*) Switches shall be placed on all service wires, either overhead or underground, in the nearest readily accessible place to the point where the wires enter the building. The service switch, unless mounted on a switch board accessible only to qualified persons, shall be enclosed in a grounded metal case; it shall indicate plainly whether it is open or closed, and shall disconnect all conductors of the circuit, provided, however, that:

(1) Where the switch, fuses and meter are combined in an approved device or compact combination of such devices having no live parts or wiring exposed,

(24) Switches—continued.

and capable of being sealed or locked, the switch may be so connected that it will not disconnect the fuses or the meter from the supply line; and the potential coils of the meter may be connected on the supply side of the service cut-out.

(2) Where the switch and fuses are mounted in an approved cabinet having no live parts or wiring exposed and capable of being sealed or locked, the switch blade may be omitted in any grounded conductor if other means is provided for disconnecting such conductor. Unless additional switches are provided for control of individual circuits, as specified in this rule, the service switch shall be operable without opening its enclosure.

In premises having private plants the yard conductors running from building to building are not considered as service conductors, so that switches would not be required in each building if there are other switches conveniently located on the mains or if the generators are near at hand.

It is recommended that where the current of a single circuit, or group of circuits, is separately metered, as in apartment house installations, a switch and cut-out shall be installed to control such separately metered installation. The location of this switch and cut-out may, or may not be close to the meter. This switch and cut-out controlling the metered load shall be enclosed and the switch shall be operable without opening the enclosure.

(*b*) Must always be placed in dry-accessible places, and be grouped as far as possible. (See No. 19 (*c*).) Single throw knife switches must be so placed that gravity will not tend to close them. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal as preferred, but if the throw be vertical a locking device must be provided, so constructed as to insure the blades remaining in the open position when so set.

(24) Switches—continued.

When practicable switches must be so wired that blades will be "dead" when switch is open.

(Up to 250 volts and thirty amperes, approved indicating snap switches are to be preferred to knife switches on lighting circuits.)

(*c*) Single pole switches shall never be used as service switches except as permitted in Section (*a*), nor for the control of out-door signs or circuits located in damp places, nor be placed in any neutral or grounded wire.

Three-way switches are considered as single pole switches, and shall be so wired that only one (1) pole of the circuit will be carried to either switch.

(*d*) Where flush switches or receptacles are used, whether with conduit system or not, they must be enclosed in an approved box constructed of iron or steel, in addition to the porcelain enclosure of the switch or receptacle.

At floor outlets, attachment plugs and receptacles must be enclosed in approved floor outlet boxes especially designed for this purpose. Departure from this rule may be authorized only under special permission in writing by the Inspector of Buildings in cases where attachment plugs and receptacles are not subject to mechanical injury and the presence of moisture is not probable.

Must be supported at outlets when possible by seven-eighths-inch blocks fastened between studs flush with back of lath except when approved fittings or outlet boxes which will give proper support are used. When this cannot be done, base blocks not less than three-fourths inch in thickness securely screwed to the lathing must be provided.

(*f*) Sub-bases of incombustible, non-absorptive, insulating material which will separate the wires at least one-half inch from the surface wired over, must be in-

(24) Switches—continued.

stalled under all snap switches used in exposed knob and cleat work. Sub-bases must also be used in moulding work, but they may be made of hardwood or they may be omitted if the switch is approved for mounting directly on the moulding.

(*g*) All motor switches other than on main switchboards in power houses, shall be of an approved safety type so designed that all wires of the circuit will be broken without opening the door of the box or cabinet, or in any way exposing the operator to accidental contact with current carrying parts of the circuit.

(25) Heating Appliances:

(*a*) Heating appliances of six (6) amperes or 660 watts or less, may be used on branch circuits; heating appliances of ten (10) amperes or 1200 watts or less, may be grouped on a special circuit protected by fuses having a rated capacity not greater than 15 amperes. Each complete heating appliance, whether containing one or more heating elements, which is of more than ten (10) amperes or 1200 watts total capacity shall be supplied by a separate branch circuit, providing No. 14 wire goes into the socket or receptacle.

Each heater of more than six (6) amperes or 660 watts capacity and each group of heaters not exceeding six (6) amperes or 660 watts capacity must be controlled by a switch plainly indicating whether "on" or "off," located within sight of the heater arranged to cut off all current from the heater. Where the capacity of the heater does not exceed fifteen (15) amperes or 1200 watts an approved plug connector may be employed in lieu of a switch. Switches controlling subdivided circuits of a heater are not considered as taking the place of the main switch called for by this paragraph. The single pole switches on the individual units of electric ranges and similar devices are not to be considered as taking the place of the switch herein required.

(25) Heating Appliances—continued.

(*b*) Flexible conductors for smoothing irons and sad irons and for all devices requiring over 250 watts must have an approved insulation and covering complying with the requirements of No. 51 (*i*).

(*c*) With portable heating devices, approved plug connector must be used, so arranged that the plug may be pulled out to open the circuit without leaving any live parts so exposed as to render likely accidental contact therewith. The connector may be located at either end of the flexible conductor or inserted in the conductor itself when used for commercial purposes.

(*d*) Smoothing irons, sad irons and other heating devices that are intended to be applied to combustible articles, must be provided with approved stands, and each such heating device, when attached to plug outlet, or group of device when attached to plug outlets, to be provided with signal lights or with approved protective devices.

(*e*) Stationary heaters, such as radiators, ranges, plate warmers and similar devices must be so located as to furnish ample protection between the devices and surrounding combustible materials.

The metal frames of such stationary heaters and similar devices must be grounded as provided in No. 15 (*a*). When grounding is impracticable the frame must be permanently and effectively insulated.

(*f*) Must each be provided with a name-plate giving the maker's name and the normal capacity in volts and emperes, or in volts and watts.

LOW-POTENTIAL SYSTEM.

550 VOLTS OR LESS.

Any circuit attached to any transforming device, machine, or combination of machines, which develops a difference of potential between any two wires or between any wire and the ground of not over 550 *volts, shall be considered as a low-potential circuit, and as coming under this class. The primary circuit not to exceed a potential of* 3,500 *volts, unless the primary wires are installed in accordance with the requirements as given in No.* 13, *or are underground. For* 550 *volt motor equipment a margin of ten per cent. above* 550 *volt limit will be allowed at the generator or transformer.*

GENERAL RULES.

(26) Wires:

(*See also Nos.* 16, 17, 18, 20 *and* 27. *For construction rules see Nos.* 49 *to* 57.)

(*a*) For conductor sizes No. 8 and smaller the neutral conductor on all three-wire circuits and one conductor on all two-wire circuits shall have continuous identifying marker readily distinguishing it from the other conductors. Not more than four (4) No. 14 B. & S. gage wires, nor any circuit protected by fuses larger than 20 amperes at 125 volts or 10 amperes at 250 volts shall be placed in any metal race-way.

When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in No. 15A.

(*b*) When entering cabinets, cut-out boxes or junction boxes, except where they are in conduit, armored cable or metal race-ways, they must be protected by incombustible, non-absorptive, insulating bushings, which fit tightly the holes in the box or cabinet and are well secured in place. The wires must completely fill the holes in the bushings so as to keep out dust,

(26) Wires—continued.

tape being used to build up the wires if necessary. For concealed knob and tube work, or for open work, in dry places approved flexible tubing will be accepted in lieu of bushings, providing it extends from the last porcelain support into a wooden cabinet cutout box, junction or switch-box by an approved fitting.

(*c*) Must not be laid in plaster, cement or similar finish, and must never be fastened with staples.

Must not be fished for any great distance, and only in places where the inspector can satisfy himself that the rules have been complied with.

(*d*) Twin wires must never be used except in conduits or where flexible conductors are necessary.

(*e*) Must, where exposed to mechanical injury, be suitably protected. When crossing floor timbers in cellars or rooms where they might be exposed to injury wires must be installed in approved conduit or armored cable or be otherwise properly guarded. Where running boards are acceptable they must be not less than one-half inch in thickness and not less than three inches in width; where guard strips are acceptable these must not be less than three-fourth inch in thickness and at least as high as the insulators and must be placed on each side of and close to the wires.

Protection on side walls must extend not less than seven feet from the floor and must consist of substantial boxing retaining an air space of one inch around the conductors, closed at the top (the wires passing through bushed holes) or approved metal conduit or pipe of equivalent strength.

When metal conduit or pipe is used, the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it, unless the conduit is installed according to No. 28 (Sections (*c*) and (*f*) excepted) and approved conduit wire is used. The two or more wires of a circuit each with its flexible tubing (when required), if carrying alternating current must, or if direct current may, be placed within the same pipe.

(26) Wires—continued.

Permission is hereby given to use wooden boxing in damp places where metal piping is not sufficiently insulated. However, near belts, pulleys and similar situations, metal piping must be used.

(*f*) When run in unfinished attics or roof spaces wiring will be considered as concealed when said spaces are inaccessible and may be run knob and tube; and will be considered as exposed to mechanical injury when said spaces are accessible and liable to be used, in which case wiring must not be run on knobs on the upper edge of joists.

When running in close proximity to water tanks and pipes wiring will be considered as exposed to moisture.

SPECIAL RULES.

For Open Work:

In dry places:

(*g*) Must have an approved rubber (Type Letter R for wires smaller than No. 6 B. & S. gage and Type Letters R. D. for wires No. 6 and larger) slow burning weather-proof of (Type Letters S. B. W.) or slow burning insulation (Type Letters S. B.).

(*h*) Any building that is not used as a residence or apartment house (with more than four apartments) shall be wired with conduit or metal race-ways. No open wiring will be permitted in any basement or cellar.

Must be rigidly supported on incombustible, non-absorptive insulators, which will separate the wires from each other and from the surface wired over in accordance with the following table:

Voltage.	Distance from Surface.	Distance between Wires.
0 to 300	½ inch	2½ inches
301 to 550	1 inch	4 inches

(26) Wires—continued.

For the purpose of rigid supports above required, wiring along flat surfaces shall be supported at least every four and one-half feet. Wherever wires are liable to be disturbed the distance between supports must be shortened. Wherever mains are not liable to be disturbed they may be supported from timber to timber without breaking around if separated about 6 inches from each other.

Must not be "dead-ended" at a rosette, socket or receptacle unless the last support is within twelve inches of the same.

In damp places or buildings especially subject to moisture or to acid or other fumes liable to injure the wires or their insulation.

(*i*) Must have approved insulating covering.

For protection against water, rubber insulation must be used. For protection against corrosive vapors, either weather-proof or rubber insulation must be used.

(*j*) Must be rigidly supported on incombustible, non-absorptive insulators, which separate the wire at least one inch from the surface wire over, and must be kept apart at least two and one-half inches for voltages up to 300 and four inches for higher voltages.

For the purpose of rigid supports above required, wiring along flat surfaces shall be supported at least every four and one-half feet. Wherever wiring is liable to be disturbed the distance between supports must be shortened.

Mains of not less than No. 8 B. & S. gage in buildings of slow burning or mill construction, where not liable to become disturbed may be supported from timber without breaking around if separated about 6 inches from each other.

(26) Wires—continued.

For Surface Wiring Raceways:

(Wooden and Metal—See No. 29. For construction of Race-ways see No. 60.)

(*k*) Must have an approved rubber insulating covering (Type Letters R for wires smaller than No. 6 B. & S. gage, and Type Letters R. D. for wires No. 6 and larger), and must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps to be made in the raceway. Where branch taps are necessary in raceway, approved fittings for this purpose must be used.

(*l*) Must never be placed in either metal or wooden raceways in damp locations; must never be placed in either metal or wooden raceways in concealed locations or where the difference of potential between any two wires in the same system is over 300 volts. When the electrical construction is being carried out in metal raceways permission will be given to extend these raceways through walls and partitions if the raceways are in continuous lengths where passing through the walls and partitions. Not more than four No. 14 B. & S. gage rubber covered wires, and no single circuit of more than 1200 watts shall be used in metal raceways.

(*m*) Must for alternating current systems, if in metal raceways, have the two or more wires of a circuit installed in the same raceway.

For Conduit Work:

(*n*) Must have an approved rubber insulated covering, and within the conduit tubing must be without splices or taps. Must be double braided (Type Letters R. D.) for twin, twisted pair or multiple conductor cables and for all single conductors of No. 6 B. & S. gage and larger.

Slow burning insulation may, however, be used in permanently dry locations where excessive tempera-

(26) Wires—continued.

tures are present, provided special permission in writing be given in advance by the Inspector of Buildings.

(*o*) Must not be drawn in until all mechanical work on the building has been, as far as possible, completed.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:

No. 14 to 0 inclusive 100. No. 00 to 0000 inclusive every 80 feet. Above 0000 to 350,000 C. M. inclusive every 60 feet. Above 350,000 C. M. to 500,000 C. M. inclusive every 50 feet.

Above 500,000 C. M. to 750,000 C. M. inclusive every 40 feet.

Above 750,000 C. M. every 35 feet.

Any one of the following methods or their equivalent may be used for supporting cables:

1. Approved clamping devices constructed of or employing insulating wedges inserted in the ends of conduits.

2. Junction boxes may be inserted in the conduit system at the required intervals, in which insulating supports of approved type must be installed and secured in satisfactory manner so as to withstand the weight of the conductors attached thereto, the boxes to be provided with proper covers.

3. Cables may be supported in junction boxes on two or more insulating supports so placed that the conductors will be deflected at an angle of not less than 90 degrees, and carried a distance of not less than twice the diameter of the cable from its vertical position. Cables so suspended may be additionally secured to these insulators by tie wires.

(26) Wires—continued.

Conductors No. 2 B. & S. gage, or larger, must not be deflected where they enter or leave the cabinet except that conductors of No. 2 B. & S. gage to 250,000 C. M. inclusive, if brought into the cabinet, cut-out box, junction or pull box opposite to the panel lugs in which they terminate may be deflected sufficiently to permit their attachment to these lugs provided the gutter of the cabinet is not less than 4 inches in width.

(*p*) Must for alternating systems have the two or more wires of a circuit drawn in the same conduit. Except in the case of stage pocket and border circuits the same conduit must not contain more than four two-wire or three three-wire circuits of the same system, except by special permission and must never contain circuits of different systems.

For Concealed "Knob and Tube" Work:

(*q*) Must have an approved rubber insulating covering. (Type Letter R. for wires smaller than No. 6 B. & S. gage, and Type Letters R. D. for wires No. 6 and larger.)

(*r*) Must be rigidly supported on incombustible, non-absorptive insulators which separate the wire at least one inch from the surface wired over. Should preferably be run singly on separate timbers, or studding, and must be kept at least five inches apart,

Must be separated from contact with the walls, floor timbers and partitions through which they may pass by incombustible, non-absorptive, insulating tubes, such as glass or porcelain. Wires passing through cross timbers in plastered partitions must be protected by an additional tube extending at least four inches above the timber.

For the purpose of rigid supports above required, wiring along flat surfaces shall be supported at least every four and one-half feet. Wherever wiring is liable to be disturbed the distance between supports must be shortened.

(26) Wires—continued.

At distributing centers, meters, outlets, switches or other places where space is limited and the five-inch separation cannot be maintained, each wire must be separately encased in a continuous length of approved flexible or other tubing.

(*s*) When in a concealed knob and tube system, it is impracticable to place the whole of a circuit on incombustible support of glass or porcelain, that portion of the circuit which cannot be so supported must be installed with approved metal conduit or approved armored cable, except that if the difference of potential between the wires is not over 300 volts, and if the wires are not exposed to moisture, they may be fished if separately encased in approved flexible tubing, extending in continuous lengths from porcelain support to porcelain support, from porcelain support to outlet, or from outlet to outlet.

(*t*) When using either conduit or armored cable in mixed concealed knob and tube work, the requirements for conduit work or armored cable work must be complied with as the case may be, except that approved fittings having a separate bushed hole for each conductor may be used for terminating the conduit or armored cable where wires pass from the conduit or cable without splice, joint or tap.

(*u*) Must at all outlets, except where conduit is used, be protected by approved flexible tubing, extending in continuous lengths from the last porcelain support to at least one inch beyond the outlet. In the case of combination gas and electric outlets, the tubes on the wires must extend at least flush with the outlet ends of gas caps, and if box or plate is used, gas pipes must be securely fastened into the outlet box or plate to secure good electrical connection.

When the surface at any outlet is broken, it must be repaired as to leave no holes or open spaces at such outlet.

(26) Wires—continued.

For concealed work in walls and ceilings composed of plaster on wooden joist or stud construction, outlet boxes or plates if used, and also cabinets or switch boxes must be so installed that the front edge will not be more than one-fourth inch back of the finished surface of the plaster, and if this surface is broken or incomplete it shall be repaired so that it will not show any gaps or open spaces around the edges of the outlet box or plate if used, or of the cabinet or plates, and cabinets or switch boxes must be so installed that the front edge will either be flush with the finished surface or project therefrom.

Approved outlet boxes, or plates, shall be installed at all outlets and the flexible tubing shall extend into and be secured to, such boxes or plates.

Knobs will not be approved in connection with any exposed wiring in buildings.

(*v*) Where the service wires enter a building above ground, they shall not be less than fourteen feet from the ground, and at least two feet of each conductor shall be left for the connection to the service.

(*w*) Where the service wires are to be run underground from the Lighting Co.'s overhead lines, each conductor shall be not less than No. 8 B. & S. gage, lead encased cable and shall run to a point nine inches below the bottom of the Lighting Co.'s rack and be dead-ended in an approved manner. At least one foot of each of the conductors shall be left for the connection to the service. The cable to run in a suitable pipe to a point eight feet above ground and the remainder of the cable on pole must be run in rigid fibre conduit or be protected with half round wood moulding.

(*x*) No dwelling shall be wired with less than two fused branch circuits in connection with lighting, and not less than three branch circuits when three or more stories in height.

(26) Wires—continued.

The branch circuits shall be arranged so as to allow for not less than the following watts for each of the various rooms, etc.:

Parlor, living room or sitting room and dining room not less than 150 watts each.

Bed rooms and cellars not less than 100 watts each.

Halls, pantry, bath and other rooms not less than 50 watts each.

The above shall be exclusive of any plug receptacles installed in such rooms, and for such, an allowance shall be made of not less than 250 watts for each receptacle so installed.

Kitchen must be on a separate circuit and may include plug receptacles for irons, side brackets or ceiling fixture.

Any plug receptacle installed in a laundry for iron or washing machine shall be on a separate circuit.

An allowance of not less than 50 watts shall be made for each lamp socket or receptacle installed, except for candelabra sockets for which an allowance of not less than 25 watts shall be allowed.

(*y*) When receptacles are to be placed on baseboards, the receptacles shall be of the flush type.

(*z*) The following is the minimum watts that shall be allowed in connection with show windows:

0″	to 6″	between outlets,	50 watts each
6″	to 12″	between outlets,	80 watts each
12″	to 18″	between outlets,	100 watts each
18″	to 24″	between outlets,	150 watts each
Over	24″	between outlets,	200 watts each

Not more than two outlets for mogul sockets shall be placed on a circuit. Only porcelain sockets or receptacles shall be used in connection with show windows.

(27) Armored Cables:

(*See also No.* 26 (*s*). *For construction of Armored Cables see No.* 54.)

(*a*) Must be continuous from outlet to outlet or to junction boxes or cabinets, and the armor of the cable must properly enter and be secured to all fittings, and the entire system must be mechanically secured in position.

In case of service connection and main runs, this involves running such armored cable continuously into a main cutout cabinet or gutter surrounding the panel board, as the case may be.

(*b*) Must be equipped at every outlet with an approved outlet box or plate as required in conduit work.

In new buildings under construction, outlet boxes having a depth of at least 1½" shall be provided for all side wall outlets.

Outlet plates must not be used where it is practicable to install outlet boxes.

For concealed work in walls and ceilings composed of plaster on wooden joist or stud construction, outlet boxes or plates and also cut-out cabinets must be so installed that the front edge will be not more than one-fourth inch back of the finished surface of the plaster, and if this surface is broken or incomplete it shall be repaired so that it will not show any gaps or open spaces around the edges of the outlet box or plate or of the cutout cabinet. On wooden walls or ceilings, outlet boxes or plates and cutout cabinets must be so installed that the front edge will either be flush with the finished surface or project therefrom. This will not apply to concealed work in walls or ceilings composed of concrete, tile or other incombustible material.

In buildings already constructed where the conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted by special permission in writing by the Inspector of Buildings provided the armored cable is firmly and rigidly secured in place.

(27) Armored Cables—continued.

At exposed ends of armored cable (except fixture outlets) where the wires pass from armored cable system without splice, joint or tap an approved fitting having a separate bushed hole for each conductor must be used.

(*c*) Must have the metal armor of cables grounded as required in No. 15A.

(*d*) When installed in so-called fire-proof buildings in course of construction, or afterwards if exposed to moisture, or where it is exposed to the weather, or in damp places, such as breweries, stables, and similar occupancies, the cable must have a lead covering, placed between the outer braid of the conductors and the steel armor.

The lead covering is not to be required when the cable is run against brick walls or laid in ordinary plaster walls unless same are continuously damp.

(*e*) Where entering junction boxes, and at all other outlets, similar devices must be provided with approved terminal fittings which will protect the insulation of the conductors from abrasion, unless such protection is afforded by the junction or outlet boxes themselves.

(*f*) Junction boxes must always be installed in such a manner as to be accessible except as provided in No. 26 (*t*).

Such boxes are considered to be accessible when installed in an attic that has sufficient head room, but which is reached only by a portable ladder and permanent hatch.

(*g*) For alternating current systems must have the two or more conductors of the circuit inclosed in one metal armor.

(*h*) All bends must be so made that the armor of the cable will not be injured. The radius of the curve of the inner edge of any bend not to be less than 1½ inches.

(28) **Interior Conduits:**

(*See also No.* 26, (*n*) *to* (*p*). *For construction of Conduit see No.* 58 *and for construction of outlet, junction and flush switch boxes see No.* 59).

(*a*) No conduit smaller than one-half inch electrical trade size shall be used.

(*b*) Must be continuous from outlet to outlet or to junction boxes or cabinets and the conduit must properly enter, and be secured to all fittings and the entire system must be mechanically secured in position.

For this purpose each conduit for service connections and main runs must be run continuously into a main cut-out cabinet or gutter surrounding the panel board as the case may be.

Departure from the foregoing may be authorized in case of underground service by special permission in writing by the Inspector of Buildings.

(*c*) Must be first installed as a complete conduit system, without the conductors.

(*d*) Must be equipped at every outlet with an approved outlet box or plate. At exposed ends of conduit (but not at fixture outlets) where wires pass from the conduit system without splice, joint or tap, an approved fitting having separately bushed holes for each conductor must be used. Departure from this rule may be authorized by special permission in writing by the Inspector of Buildings.

Outlet plates must not be used where it is practicable to install outlet boxes.

For concealed work in walls and ceilings composed of plaster on wooden joist or stud construction, outlet boxes or plates and also cut-out cabinets must be so installed that the front edge will be not more than one-fourth inch back of the finished surface of the plaster, and if this surface is broken or incomplete it shall be repaired so that it will not show any gaps or

(28) Interior Conduits—continued.

open spaces around the edges of the outlet box or plate or of the cut-out cabinet. On wooden walls or ceilings, outlet boxes or plates and cut-out cabinets must be so installed that the front edge will either be flush with the finished surface or project therefrom. This will not apply to concealed work in walls or ceilings composed of concrete, tile or other incombustible material.

In buildings already constructed where the conditions are such that neither outlet box nor plate can be installed, these appliances may be omitted, providing the conduit ends are bushed and secured.

(*e*) Metal conduits where they enter junction boxes, and at all other outlets, and similar devices, must be provided with approved bushings or fastening plates fitted so as to protect wire from abrasion, except when such protection is obtained by the use of approved nipples, properly fitted in boxes or devices.

(*f*) Must have metal of the conduit grounded as required in No. 15A.

(*g*) Junction boxes must always be installed in such a manner as to be accessible except as provided for in No. 26 (*t*). Such boxes are considered to be accessible when installed in an attic that has sufficient headroom, but which is reached only by a portable ladder and permanent hatch.

(*h*) All elbows or bends must be so made that the conduit will not be injured. The radius of the curve of the inner edge of any elbow not to be less than three and one-half inches. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not being counted.

(*i*) **Size of Conduits for the Installation of Wires and Cables:**

The following tables apply only to complete conduit systems and do not apply to short sections of conduit used for the protection of exposed wiring from mechanical injury.

TABLE 1. TWO-WIRE AND THREE-WIRE SYSTEMS.

Size of Conductor. B. & S. Gage.	Number of Conductors in one Conduit.								
	1	2	3	4	5	6	7	8	9
	Minimum Size of Conduit in Inches.								
14	½	½	½	¾	¾	1	1	1	1
12	½	½	¾	¾	¾	1	1	1	1¼
10	½	¾	¾	1	1	1	1¼	1¼	1¼
8	½	¾	1	1	1	1¼	1¼	1¼	1¼
6	½	1	1¼	1¼	1½	1½	2	2	2
5	¾	1¼	1¼	1¼	1½	2	2	2	2
4	¾	1¼	1¼	1½	2	2	2	2	2½
3	¾	1¼	1¼	1½	2	2	2	2½	2½
2	¾	1¼	1½	1½	2	2	2½	2½	2½
1	¾	1½	1½	2	2	2½	2½	3	3
0	1	1½	2	2	2½	2½	3	3	3
00	1	2	2	2½	2½	3	3	3	3½
000	1	2	2	2½					
0000	1¼	2	2½	2½					
200000 C. M.	1¼	2	2½	2½					
225000	1¼	2½	2½	3					
250000	1¼	2½	2½	3					
300000	1¼	2½	3	3					
350000	1¼	2½	3	3½					
400000	1¼	3	3	3½					
450000	1½	3	3	3½					
500000	1½	3	3	3½					
550000	1½	3	3½	4					
600000	2	3	3½	4					
650000	2	3½	3½	4					
700000	2	3½	3½	4½					
750000	2	3½	3½	4½					
800000	2	3½	4	4½					
850000	2	3½	4	4½					
900000	2	2½	4	4½					
950000	2	4	4	5					
1000000	2	4	4	5					
1100000	2½	4	4½	6					
1200000	2½	4½	4½	6					
1250005	2½	4½	4½	6					
1300000	2½	4½	5	6					
1400000	2½	4½	5	6					
1500000	2½	4½	5	6					
1600000	2½	5	5	6					
1700000	3	5	5	6					
1750000	3	5	5	6					
1800000	3	5	6	6					
1900000	3	5	6	6					
2000000	3	5	6						

Where single conductor, single braid, solid wires only, are used, four (4) No. 14 B. & S. gage wires may be installed in a ½" conduit and up to seven (7) No.

(28) Interior Conduits—continued.

14 B. & S. gage wires in a ¾" conduit. Three (3) No. 12 B. & S. gage wires may be installed in a ½" conduit and three (3) No. 8 B. & S. gage wires in a ¾" conduit.

For sizes not greater than No. 10 B. & S. gage, one more conductor than permitted by the opposite table may be installed in the specified conduit provided the conduit is not longer than 30 feet, and has not more than the equivalent of two quarter bends from outlet to outlet, the bends at the outlets not being counted.

TABLE 2. THREE CONDUCTOR CONVERTIBLE SYSTEM.

Size of Conductors. B. & S. Gage.				Size Conduit in Electrical Trade Size.
two	14	and one	10	¾
"	12	"	8	¾
"	10	"	6	1
"	8	"	4	1
"	6	"	2	1¼
"	5	"	1	1¼
"	4	"	0	1½
"	3	"	00	1½
"	2	"	000	1½
"	1	"	0000	2
"	0	"	250000	2
"	00	"	350000	2½
"	000	"	400000	2½
"	0000	"	550000	3
"	250000	"	600000	3
"	300000	"	800000	3
"	400000	"	1000000	3½
"	500000	"	1250000	4
"	600000	"	1500000	4
"	700000	"	1750000	4½
"	800000	"	2000000	4½

The following table may be used for stage pockets and border circuits, and also by special permission of the Inspector of Buildings:

(28) Interior Conduits—continued.

TABLE 3. STAGE POCKET AND BORDER CIRCUITS.

Size of Conductor.	Maximum Number of Conductors in Conduit.					
B. & S. Gage.	1 Ins.	1¼ Ins.	1½ Ins.	2 Ins.	2½ Ins.	3 Ins.
14	11	19	26	43	61	95
12		15	21	34	50	77
10		12	16	27	38	60
8			13	22	31	49
6					14	22

For groups or combinations not included in the above tables, consult the Inspector of Buildings. For such groups or combinations, it is recommended that the conduit be of such size, that the sum of the areas of the several conductors will not be more than 40 per cent. of the area of the conduit.

(29) Metal Raceways for Surface Wiring:

(*See also No.* 26 (*k*) *to* (*m*). *For construction of raceways see No.* 60.)

(*a*) *Left blank for future use.*

(*b*) Must be continuous from outlet to outlet, to junction boxes, or approved fitting designed especially for use with metal raceways, and must at all outlets be provided with approved terminal fittings which will protect the insulation of conductors from abrasion, unless such protection is afforded by the construction of the boxes or fittings.

(*c*) Such raceways where passing through a floor must be carried through an iron pipe extending from the ceiling below to a point five feet above the floor, which will serve as an additional mechanical protection and exclude the presence of moisture often prevalent in such locations.

Where the mechanical strength of the raceway itself is adequate, the foregoing may be modified to require the protecting piping from the ceiling below to a point at least three inches above the flooring.

(29) Metal Raceways for Surface Wiring—continued.

Where such raceways pass through a partition the iron pipe required for passing through floors may be omitted and the raceway passed directly through, providing the partition is dry and the raceway is in a continuous length with no joint or coupling within the partition.

(*d*) The heads of screws or bolts placed within the raceway must be flush with metal.

(*e*) Must have the metal raceways grounded as required in No. 15A.

(*f*) Must be installed so that for alternating systems the two or more wires of a circuit will be in the same metal raceway.

(30) Fixtures:

(*For construction of fixture wires see No.* 52. *For construction of fixtures see No.* 77. *For gas-filled lamps see No.* 35.)

(*a*) Must, except in the cases mentioned in items 1-4 inclusive below, be insulated from their supports by approved insulating joints placed as close as possible to the ceiling or walls.

Where insulating joints are required, fixture canopies of metal must be thoroughly and permanently insulated from metal walls or ceilings or from plaster walls or ceilings on metal lathing and from outlet boxes. Canopy insulators must be securely fastened in place so as to separate the canopies thoroughly and permanently from the surface and outlet boxes from which they are designed to be insulated.

Gas pipes must be protected above the insulating joints or blind hickeys by approved insulating tubing, and where outlet tubes are used, they must be of sufficient length to extend below the insulating joint and must be so secured that they will not be pushed back when the canopy is put in place.

(30) Fixtures—continued.

Insulating joints and canopy insulators may be omitted in the following cases:

1. Straight electric fixtures connected to knob and tube, wooden raceways or open work, except on metal ceilings or on plaster walls or ceilings containing metal lathing.

2. Straight electric fixtures in which all wires have an approved rubber insulation not less than three sixty-fourths inch in thickness and which are metallically connected in a permanent and effective manner to metal conduit, armored cable or metal raceway systems. The insulating joints may be omitted provided such piping is grounded in the manner prescribed for conduit in No. 15A.

3. Straight electric fixtures in which all wires have an approved rubber insulation not less than three sixty-fourths inch in thickness and which are permanently and effectively grounded to a separate ground wire not smaller than No. 10 B. & S. gage.

4. Combination fixtures in which all wires have an approved rubber insulation not less than three sixty-fourths inch in thickness and where piping is grounded, as in item 2 above, for fixtures which are not attached to gas pipes or conduit unless outlet boxes or other approved fittings which will give proper support for fixtures are used, not less than three-fourths inch block must be fastened between studs or floor timbers flush with the back of lathing to hold tubing and to support fixtures. When this cannot be done, wooden base blocks, not less than three-fourths inch in thickness, securely screwed to lathing, must be provided.

Fixtures having so-called flat canopies, tops or backs, will not be approved for installation except where the outlet boxes having a depth of at least 1½" are used.

(30) Fixtures—continued.

(*b*) When installed out of doors must be of water tight construction.

(*c*) Fixture wires must be not smaller than No. 18 B. & S. gage, and must have an approved insulating covering (see No. 52).

In wiring certain designs of show-case fixtures, ceiling bulls-eyes and similar appliances in which the wiring is exposed to temperatures in excess of 120 deg. Fahrenheit (49 degrees Centigrade) from the heat of the lamps, conductors having approved slow burning or other heat resisting coverings must be used.

(*d*) Supply conductors, and especially the splices to fixture wires, must be kept clear of the grounded part of gas pipes, and where shells or outlet boxes are used, they must be made sufficiently large to allow the fulfilment of this requirement.

(*e*) Must, when wired on the outside, have the conductors so secured as not to be cut or abraded by the pressure of the fastenings or motion of the fixture.

Must not, when wired on the outside, be used in show windows or in the immediate vicinity of especially inflammable materials, except as provided in No. 32 (*e*) for chain fixtures. Chain fixtures must be wired with flexible conductors.

(*f*) Wires of different systems must never be contained in or attached to the same fixture, and under no circumstances must there be a difference of potential of more than 220 volts between wires contained in or attached to the same fixtures.

(*g*) Must be free from short circuits between conductors and from contacts between conductors and metal parts of fixtures, and must be tested for such conditions before being connected to supply conductors.

(31) Sockets:

(*For construction of Sockets see No.* 72.)

(*a*) In rooms where inflammable gases may exist the incandescent lamp and socket must be enclosed in a vapor-tight globe, and supported on a pipe-hanger, wired with approved rubber-covered wire soldered directly to the circuit, and in places where combustible dust is thrown into suspension in the air in sufficient quantities to produce explosive mixtures, dust-tight fixtures enclosing lamps and sockets shall be used. Such fixtures should be supported by conduit hangers or chains to prevent any strain on the wires. Wires should have rubber insulation not less than 3/64 inch thick.

(*b*) In damp or wet places, or where exposed to corrosive vapors, weather-proof sockets especially approved for the location must be used. Unless made up on fixtures they must be hung by separate stranded rubber-covered wires not smaller than No. 14 B. & S. gage, which should preferably be twisted together when the pendant is over three feet long.

These wires must be soldered direct to the circuit wires, but supported independently of them.

660 watt sockets and receptacles are recommended for use in kitchen and laundrys.

(*c*) Sockets and receptacles installed over specially inflammable materials or where exposed to flyings of combustible material, must be of the keyless type, and unless individual switches are provided, must be installed at least seven and one-half feet above the floor, or must be so located or guarded that the lamps cannot be readily backed out by hand.

(*d*) When the socket is not attached to a fixture, the inlet must be provided with an approved insulating bushing, which if threaded must be not less than three-eighth inch pipe size.

The edges of bushing must be rounded and all inside fins removed so that in no case will cord be subjected to the cutting or wearing action of a sharp edge.

(31) Sockets—continued.

Bushings must have holes not less than 9-32-inch in diameter for plain pendant cord, and 13-32-inch in diameter for reinforced cord.

(32) Flexible Cord:

(*For construction of Flexible Cord see No.* 51.)

(*a*) Must have an approved insulation and covering.

(*b*) When used where the voltage between any two conductors or from any conductor to the ground is over 300 volts, shall have insulation on the individual conductors at least 3/64 inch in thickness for all conductors sizes No. 8 or less, except in street railway properties where cords Nos. 16 and 18 supplying pendant lamps may have insulation 1/32 inch in thickness.

(*c*) *Left blank for future use.*

(*d*) Must not be used except for pendants, wiring of fixtures, portable lamps or motors, portable heating apparatus or other portable devices.

For all portable work including these pendants which are liable to be moved about sufficiently to come in contact with surrounding objects, flexible wires and cables especially designed to withstand this severe service must be used.

When necessary to prevent portable lamps from coming in contact with inflammable materials or to protect them from breakage, they must be surrounded with a substantial guard, which must be securely attached to the socket or handle.

(*e*) Unless provided with approved metal armor, must not be used in show windows or in showcases, except that approved portable cord may be used for the purpose of supplying current to portable lamps and other devices for exhibition purposes, and flexible cord may be used for chain fixtures.

(32) Flexible Cord—continued.

(*f*) Must be protected by approved insulating bushings where the cord enters the socket.

(*g*) Must be so connected to all fittings that strain is taken from the joints and binding screws.

(*h*) Must, where passing through covers of outlet boxes, be protected by approved bushings especially designed for this purpose, or the cover must be provided with a smooth, well-rounded surface on which the cord will bear. So-called hard rubber or composition bushings must not be used.

(33) Arc Lamps on Constant-Potential Circuits:

(*a*) Must have a cut-out (see No. 19 (*a*) for each lamp or each series of lamps.

The branch conductor must have a carrying capacity about fifty per cent. in excess of the normal current required by the lamp.

(*b*) Must only be furnished with such resistances or regulators as are enclosed in incombustible material, such resistances being treated as sources of heat. Incandescent lamps must not be used for this purpose.

(*c*) Must be supplied with globes and protected by spark arresters and wire netting around the globe, as in the case of series arc lamps (see No. 21).

Outside arc lamps must be suspended at least eight feet above sidewalks. Inside arc lamps must be placed out of reach or suitably protected.

(*d*) Lamps when arranged to be raised and lowered, either for carboning or other purposes, shall be connected up with stranded conductors from the last point of support to the lamp, when such conductor is larger than No. 14 B. & S. gage.

(*e*) Economy and compensator coils for arc lamps must be mounted on incombustible, non-absorptive, insulating supports, such as glass or porcelain, allowing an air space of at least one inch between frame and support, and must in general be treated as sources of heat.

(34) Vapor Lamps:

Enclosed Mercury Vapor Lamps:

(*a*) Must have cut-out for each lamp or series of lamps except when contained in single frame and lighted by a single operation, in which case not more than five lamps should be dependent upon single cut-out.

(*b*) Must only be furnished with such resistance or regulators as are enclosed in incombustible cases, such resistances to be treated as sources of heat. In locations where these resistances or regulators are subject to flyings of lint or combustible material, all openings through cases must be protected by fine wire gauze.

High-Potential Vacuum Systems:

(*c*) The tube must be so installed as to be free from mechanical injury or liability to contact with inflammable material.

(*d*) High-potential coils and regulating apparatus must be installed in an approved steel cabinet not less than one-tenth inch in thickness; same to be well ventilated in such a manner as to prevent the escape of any flame or sparks in case of burnout in the various coils. All apparatus in this box must be mounted on slate base and the enclosing case positively grounded. Supplying conductors leading into high-potential case to be installed in accordance with the standard requirements governing low-potential systems, where such wires do not carry a potential of over 300 volts.

(35) Gas Filled Incandescent Lamps:

(*a*) Shall not be used in show windows or in other locations where liable to contact with inflammable material unless installed in fixtures equipped with shades or guards, or suitably designed to operate at a safe temperature.

Must be so grouped that not more than 660 watts (nor more than 12 sockets or receptacles) are to be dependent on one cut-out except that in cases where

(35) Gas Filled Incandescent Lamps—continued.

wiring equal in size to No. 14 B. & S. gage is carried directly into keyless sockets or receptacles, the location of which is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1200 watts for 24 sockets or receptacles, will be dependent on the final cut-out. Where a single socket or receptacle is used on a circuit the limitation of watts permissible on the final cut-out shall be the maximum capacity for which such socket or receptacle is approved.

(*b*) Must not be used in show windows or in other locations where inflammable material is liable to come in contact with lamp equipment except where used in connection with approved fixtures where temperature of any exposed portion of same does not exceed 200 degrees Fahr. (93 degrees Centigrade).

(*c*) Must not be used in connection with medium-base sockets or receptacles if of above 200 watts nominal capacity nor with Mogul base sockets or receptacles if of above 1200 watts capacity. If of above 100 watts, must not, if provided with a shade, reflector, fixture or other enclosure above the socket, be used in either medium or Mogul base types of sockets or receptacles having fibre or paper linings.

(*d*) Fixtures within buildings must be wired with conductors having provided slow-burning or other heat resisting covering where the temperature to which wire is subjected at any point exceed 120 degrees Fahr. (29 degrees Centigrade). Where fixtures are placed outside of buildings rubber insulated wire is required.

(36) Transformers:

(*See also Nos.* 11 *and* 45. *For construction of Transformers see No.* 81.)

Oil Transformers:

(*a*) When transformers are placed inside of any building except central stations or sub-stations, they

(36) Transformers—continued.

shall be placed in a transformer room enclosed on all sides, top and bottom with incombustible materials; this room to be provided with fire-proof door and frame, have the necessary ventilation and sewer drain; or in lieu of the drain a sump or 6-inch high door sill to prevent spreading of the oil.

Air Cooled Transformers:

The following sections do not apply to apparatus or fittings, the operation of which depends either wholly or in part upon special transformers embodied in the devices:

(*b*) Must not be placed inside of any building excepting central stations or sub-stations, if the highest voltage of either primary or secondary exceeds 550 volts.

(*c*) Must, with the exception of bell ringing and other signaling transformers, be so mounted that the case shall be at a distance of at least one foot from combustible material or separated therefrom by incombustible, non-absorptive, insulating material, such as slate, marble or soapstone. This will require the use of a slab or panel somewhat larger than the transformer.

Bell ringing or other signalling transformers must be protected with not more than three ampere fuses. The fuses and transformer to be installed in an approved metal box with door.

(37) Decorative Lighting Systems:

Special permission may be given in writing for the temporary installation of approved systems of Decorative Lighting, provided the difference of potential between the wires of any circuit shall not be over 150 volts and also provided that no group of lamps requiring more than 1200 watts shall be dependent on one cut-out. Fixtures and appliance attached to this circuit to be wired with not less than No. 14 wire.

(37A) Electrical Operated Organs:

The following rules apply to those electrical circuits and parts of electrical operated organs which are employed for the control of the sounding apparatus and keyboards.

They do not apply to motors, switches, resistance devices or other appliances connected to light or power circuits which must in all cases be installed in compliance with the rules of this ordinance applying to low-potential circuits.

(*a*) Source of Energy:

The source of energy must be either a self-excited generator rated at not over 15 volts or a primary battery.

The generator must either be permanently and effectively insulated both from ground and from the motor driving it or both generator and motor must have their base frames permanently and effectively grounded.

(*b*) Cables:

All wiring must be cabled except common return wires, and wires inside the organ proper, the organ sections and the organ console.

The separate conductors of the cable must not be smaller than No. 26 B. & S. gage and have either rubber, cotton or silk insulation. The cotton or silk may be separated with parafine if desired.

The separate conductors may be either bunched or cabled and must be covered by one or more braided outer coverings. A tape may be substituted for an inner braid. The outside covering of cables not run in conduit must either be flameproof or covered with a closely wound fire-proof tape.

The common return wire or wires shall not be contained in the cable, but may be run in contact with it or placed under additional covering enclosing both cable and return wires.

(37A) Electrical Operated Organs—continued.

The insulation of return wires must be either rubber or slow-burning and the wires not smaller than No. 14 B. & S. gage.

(*c*) Workmanship and Materials:

All wiring and devices within the organ or any of its parts must be neatly disposed and securely fastened.

Cables between parts of the organ and between the console and the organ must be installed in a workmanlike manner, be securely fastened in position and kept from contact with other wires. The use of conduit in said locations is not hereby required.

(*d*) Fuses:

Circuits must be so sub-divided and protected at the generator by approved enclosed fuses of not over thirty amperes capacity that every wire will be protected by one or more such fuses.

No other fuses in the organ circuits will be required.

(38) Theatre and Moving Picture Establishment Wiring:

Wiring, apparatus and similar devices, not specifically covered by special rules herein given, must conform to the general requirements of the rule, and the term "theatre" shall mean a building, or part of a building regularly or frequently used for dramatic, operatic, motion picture or other performances or shows or which has a stage for such performances used with scenery or other stage appliances.

(*a*) Services:

Where supply may be obtained from two separate street mains, passing the premises, two separate and distinct services must be installed, one service to be of sufficient capacity to supply current for the entire equipment of theatre, while the other service must be at least of sufficient capacity to supply current for all

(38) Theatre and Moving Picture Wiring—continued.

emergency lights. Where supply cannot be obtained from two separate sources, the feed for emergency lights must be taken from a point on the street side of main service fuses. By "emergency lights" are meant exit lights and all lights in lobbies, stairways, corridors and other portions of theatre to which the public have access, which are normally kept lighted during the performance.

Where source of supply is an isolated plant within same building, an auxiliary service of at least sufficient capacity to supply all emergency lights must be installed from some outside source, or a suitable storage battery within the premises may be considered the equivalent of such service.

(*b*) **Stage:**

All permanent construction on stage side of proscenium wall, except as hereinafter provided, must be approved conduit.

(*c*) **Switchboards:**

(1) Must be made of incombustible, non-absorptive insulating material, and where accessible from stage level must be protected by a suitable guard rail to prevent accidental contact with live parts on the board and comply with the requirement of Rule 3.

(2) Dimmers must be dead when the switch controlling circuit of which dimmer forms a part is open.

(*d*) **Footlights:**

Must be wired in approved conduit each lamp receptacle being enclosed within an approved outlet box, or the lamp receptacles may be mounted in an iron or steel box, metal to be of a thickness not less than No. 20 U. S. Sheet Metal gage treated to prevent oxidation, so constructed as to enclose all the wires and providing at least one-half inch separation between the metal of the box and receptacle terminals. Wires to be soldered

(38) Theatre and Moving Picture Wiring—continued.
to lugs of receptacle. Must be so wired that no set of lamps requiring more than 1200 watts nor more than 24 receptacles shall be dependent upon one cut-out.

(*e*) **Borders and Proscenium Sidelights:**

(1) Must be constructed of steel of a thickness not less than No. 20 U. S. sheet metal gage, treated to prevent oxidation, be suitably stayed and supported, and so designed that flanges of reflectors will protect lamps.

(2) Must be so wired that no set of lamps requiring more than 1200 watts nor more than 24 receptacles shall be dependent upon one cut-out.

(3) Must be wired in approved conduit, each lamp receptacle to be enclosed with an approved outlet box, or the lamp receptacles may be mounted in an iron steel box, metal to be of a thickness not less than No. 20 U. S. sheet metal gage treated to prevent oxidation, so constructed as to enclose all wires. Wires to be soldered to lugs of receptacles.

(4) Must be provided with suitable guards to prevent scenery or other combustible material coming in contact with lamps.

(5) Cable for borders must be of some approved type and suitably supported; conduit construction must be used from switchboard to point where cables must be flexible to permit of the raising and lowering of border.

(6) For the wiring of the border proper, wire with approved slow-burning insulation must be used.

(7) Borders must be suitably suspended, and if a wire rope is used, same must be insulated by at least one strain insulator inserted at the border.

(*f*) **Stage and Gallery Pockets:**

Must be of some approved type, insulated from ground and controlled from switchboard, each recep-

(38) Theatre and Moving Picture Wiring—continued.

tacle to be of not less than 35 empere rating for arc lamps nor 15 amperes for incandescent lamps, and each receptacle to be wired to its full capacity. Arc pockets to be wired with wire not smaller than No. 6 B. & S. gage and incandescent pockets with not less than No. 12 B. & S. gage.

Plugs for arcs and incandescent pockets must not be interchangeable.

(*g*) **Scene Docks:**

Where lamps are installed in Scene Docks, they must be so located and installed that they will not be liable to mechanical injury.

(*h*) **Curtain Motors:**

Must be enclosed type and installed so as to conform to the general requirements of the rule (see No. 8).

(*i*) **Control for Stage Flues:**

In cases where dampers are released by an electro device, the electric circuit operating same must be normally closed.

Magnet operating damper must be wound to take full voltage of circuit by which it is supplied, using no resistance device, and must not heat more than normal for apparatus of similar construction. It must be located in loft above scenery, and be installed in a suitable iron box with a tight, self-closing door.

Such dampers must be controlled by at least two standard single pole switches mounted within approved iron boxes provided with self-closing doors without lock or latch, and located, one at the electrician's station and others as designated.

(*j*) **Dressing Rooms:**

Must be wired in approved conduit and all pendant lights must be equipped with approved reinforced cord, armored cable, or steel armored flexible cord.

(38) Theatre and Moving Picture Wiring—continued.

All lamps must be provided with approved guards which are sealed or locked in place.

(*k*) Portable Equipment:

Arc lamps used for stage effects must conform to the following requirements:

(1) Must be constructed entirely of metal of a thickness not less than No. 20 U. S. steel metal gage except where use of approved insulating material is necessary.

(2) Must be substantially constructed, and so designed as to provide for proper ventilation, and to prevent sparks being emitted from lamps when same are in operation, and mica must be used for frame insulation.

(3) Front opening must be provided with a self-closing hinged door frame, in which wire gauze or glass must be inserted, except in the case of lens lamps where the front may be stationary, and a solid door be provided on back or side.

(4) Must be so constructed that neither carbons nor live parts will be brought into contact with metal of hood during operation, and arc lamp frames and standards must be so installed and protected as to prevent the liability of their being grounded.

(5) Switch on standard must be so constructed that accidental contact with any live portion of the same will be impossible.

(6) All stranded connections in lamp and at switch and rheostat must be provided with approved lugs.

(7) Rheostats must be plainly marked with their rated capacity in volts and amperes, and, if mounted on standard, must be raised to a height of at least three inches above floor. Resistance must be enclosed in a substantial and properly ventilated metal case which affords a clearance of at least one inch between case and resistance element.

(38) Theatre and Moving Picture Wiring—continued.

(8) A competent operator must be in charge of each arc lamp, except that one operator may have charge of two lamps when they are not more than ten feet apart, and are so located that he can properly watch and care for both lamps.

(*l*) **Bunches:**

Must be substantially constructed of metal and must not contain any exposed wiring.

The cable feeding same must be tubed in an approved manner where passing through the metal, and must be properly secured to prevent any mechanical strain from coming on the connection.

(*m*) **Strips:**

Must be constructed of steel of a thickness not less than No. 20 U. S. sheet metal gage, treated to prevent oxidation, and suitably stayed and supported and so designed that flanges will protect lamps.

Cables must be tubed in a suitable manner where passing through the metal and must be properly secured to prevent serious mechanical strain from coming on the connections.

Must be wired in approved conduit and each lamp receptacle being enclosed within an approved outlet box, or the lamp receptacles may be mounted in an iron or steel box, metal to be of a steel metal gage, treated to prevent oxidation, so constructed as to enclose all wires. Wires to be soldered to lugs of receptacles.

(*n*) **Portable Plugging Boxes:**

Must be constructed so that no current carrying part will be exposed, and each receptacle must be protected by approved fuses mounted on slate or marble bases and enclosed in a fireproof cabinet equipped with self-closing doors. Each receptacle must be constructed to

(38) Theatre and Moving Picture Wiring—continued.

carry thirty amperes without undue heating, and the bus bars must have a carrying capacity equivalent to the current required for the total number of receptacles, and approved lugs must be provided for the connection of the master cable.

(*o*) **Pin Plug Connectors:**

Must be of some approved type, so installed that the "female" part of plug will be on live end of cable, and must be so constructed that tension on the cable will not cause serious mechanical strain on the connections.

(*p*) **Portable Conductors:**

Flexible conductors used from receptacles to arc lamps, bunches and other portable equipments must be approved stage cable except that for the purpose of feeding a stand lamp under conditions where conductors are not liable to severe mechanical injury, an approved reinforced cord may be used, provided cut-out designated to protect same is not fused over ten amperes capacity.

(*q*) **Lights on Scenery:**

Where brackets are used they must be wired entirely on the inside, fixture stem must come through to the back of the scenery, and end of stem be properly bushed and fixtures to be securely fastened in position.

(*r*) **String or Festooned Lights:**

Wiring of same must be of some approved type, joints to be properly made, soldered and taped, and staggered where practicable.

Where lamps are used in lanterns or similar devices, approved guards must be employed.

(*s*) **Special Electrical Effects:**

Where devices are used for producing special effects such as lightning, water-falls, etc., the apparatus must

(38) Theatre and Moving Picture Wiring—continued.

be so constructed and located that flames, sparks, etc., resulting from the operation cannot come in contact with combustible material.

(*f*) Auditorium:

All wiring must be installed in approved conduit. Where receptacles are used they must be enclosed in approved boxes. Exit lights must not have more than one set of fuses between same and service fuse.

Exit lights and all lights in halls, corridors or any other part of the building used by audience, except the general auditorium lighting must be fed independently of the stage lighting, and must be controlled only from the lobby or other convenient place in front of the house.

All fuses must be enclosed in approved cabinets.

All doors or openings used as exits in connection with any place of amusement, such as theatre, auditorium, assembly hall, moving picture parlor, etc., shall have each marked by a sign with the word "*Exit*," the letters being at least 7" high. Such signs shall be either glass and illuminated by an electric lamp or a sign with a red lamp placed just above the same. The circuit controlling the lamps shall be connected with the emergency service as described under Rule 38 (*a*).

(38A) Moving Picture Exchanges, Factories and Studios, and Motion Picture Equipment:

Motion picture equipment for use without fireproof booth. For use without other protection than that afforded by the construction of the machine itself.

(1) Motion picture projecting machines not intended for installation and use in permanent and ventilated booths shall be permitted only for projecting film of an approved slow-burning (cellulose acetate or equivalent) type.

(2) All such equipment shall be expressly approved, including current-controlling devices and other essential operating parts.

(38A) Moving Picture Exchanges, Factories and Studios—continued.

(3) The source of illumination of the projected view shall be an incandescent lamp of a pattern expressly intended for steropticon use or for motion picture projection.

(4) Rheostats, transformers, switches and other current controlling devices must be attached to and form an integral part of the projector or its housing, shall have no live parts exposed and shall comply with the requirements of No. 65 and No. 78 or No. 81. (*a*), (*b*), (*c*).

(5) The slow-burning (cellulose acetate or equivalent) film shall have a permanent distinctive marker for its entire length identifying the manufacturer and the slow-burning character of the film stock.

(6) Machines shall be marked with the name or trademark of the maker, and with the voltage and current rating for which they are designed, and plainly marked, "For use with slow-burning films only."

For the purpose of the following a motion picture studio is considered as that building or part of a building in which nitro-cellulose or like inflammable motion picture films are exposed, developed or printed.

For the same purpose a motion picture exchange building is to be considered as that building or part of a building occupied for the demonstration, examination, storage, repair and exchange of nitro-cellulose or like inflammable motion picture films.

(*a*) All wiring must be installed in approved conduit.

(*b*) Side wall lamps must be installed in receptacles enclosed in approved outlet boxes and must be protected by approved open end guards riveted to the covers of the boxes. Pendant lamps must be equipped with approved reinforced cord, armored cable or armored flexible cord, and must be protected by substantial wire guards.

(38A) Moving Picture Exchanges, Factories and Studios—continued.

Lamp portables must be equipped with approved keyless sockets of approved composition or metal sheath porcelain type with handle, hook and substantial guard. The flexible cords for such portable lamps must be approved cord designed for rough usage. The portable cord must carry the male end of an approved pin plug connector or equivalent, the female end being of such design or so hung that the connector will break apart readily at any position of the cable.

The connector must be kept at least one foot above the floor.

Lamps at patching tables must be installed in approved composition or metal sheath porcelain keyless sockets, and must be suitably protected from mechanical injury.

(*c*) In vaults used for storage of films, lamps must be protected by vapor-proof globes, rigidly installed, and must be controlled by a double pole switch located outside each vault. No lamp, portable or electric fans will be permitted in said vaults.

(*d*) Motors must be of the enclosed type. Motor rheostats must be installed in metal cabinets of such design that all live terminals or contacts are enclosed leaving the operating handles exposed.

(*e*) Motion Picture Equipment Other Than Miniature Type:

1. *Arc Lamps.*—Arc lamps must be constructed entirely of metal of a thickness not less than No. 24 U. S. sheet metal gage, except where use of approved insulating material is necessary, and be constructed in so far as practicable in accordance with the requirements of No. 38 (*k*), 2, 3, 4 and 6, and incandescent lamps must be suitably enclosed.

2. *Rheostats.*—Rheostats, transforming devices or any substitute therefor must be approved and of types

(38A) Moving Picture Exchanges, Factories and Studios—continued.

expressly designed and approved for the purpose. Their installation and location must be subject to approval as parts of the motion picture machine.

3. *Top and Bottom Reels.*—Must be enclosed in steel boxes or magazines, each with an opening of approved construction at bottom or top, so arranged as not to permit entrance of flame to magazine. No solder is to be used in the construction of these magazines. The front side of each magazine must consist of a door swinging horizontally and be provided with a substantial latch.

4. *Automatic Shutter.*—Must be provided and must be so constructed as to shield the film from the beam of light whenever the film is not running at operating speed. Shutter must be permanently attached to the gate frame.

5. *Extra Films.*—Must be kept in individual metal boxes equipped with tight fitting covers.

6. *Machine Operation.*—Must be of an approved type. If driven by a motor, must be of a type expressly designed and approved for such operation, and when so approved motor driven machines, when in charge of a skilled operator, may be authorized under special permission in writing by the Inspector of Buildings, given in advance.

7. *Machine Enclosure.*—Machine must be placed in an enclosure or house made of suitable fireproof material; must be properly lighted and large enough for operator to walk freely on either side of or back of machine.

Ventilation for permanent booths must be provided by means of ventilating pipes having a cross section of sufficient area to supply at least 150 cu. ft. of air per minute for each machine and operator and in no case shall the exhaust pipe be less in area than 144 square inches, said pipe leading to the outside of the building

(38A) Moving Picture Exchanges, Factories and Studios—continued.

or to a special incombustible vent flue. All parts of vent pipe to be at least one inch from any combustible material or separated therefrom by means of approved incombustible heat insulating material not less than one-half inch in thickness. A fan capable of exhausting at least 150 cu. ft. of air per minute shall be installed and arranged in such a way that gas and smoke passing through the vent flue shall not come in contact with the motor. The motor must be connected to the emergency service and must not be controlled from the booth.

All openings into this booth must be arranged so as to be entirely closed by doors or shutters constructed of the same or equally good fire-resisting material as the booth itself. Doors or covers must be arranged so as to be held normally closed by spring hinges or equivalent devices.

8. *Reels Containing Films under Examination or in Process of Rewinding.*—Must be enclosed in magazines or approved metal boxes similar to those required for films in operation, and not more than two feet of film shall be exposed in booth.

(*f*) Motion Picture Equipment of Approved Miniature Type for Home Lecture and Similar Purposes:

1. All equipment must be expressly approved and such approval must cover the entire machine, including all attachments, current controlling devices and other parts employed, including also the film.

2. The entire equipment must consume not more than 660 watts.

3. Arc lamps must be constructed so far as practicable in accordance with the requirements of No. 38 (*k*), 1, 2, 3, 4 and 6, and incandescent lamps must be suitably enclosed.

(38A) Moving Picture Exchanges, Factories and Studios—continued.

4. Rheostats, transformers, switches and other similar current-controlling devices must be attached to and form a part of the machine, must have no live parts exposed, and must comply with the requirements of No. 65 and No. 78 or No. 81, (*a*), (*b*), (*c*).

5. Films must be of an approved slow-burning type having a permanent distinctive marker.

6. Machines must be so constructed that they cannot be used with films employed on the full-sized commercial moving picture machine. This may be accomplished by using a film of special width or with special perforations or by any other approved means.

Interchange of sprockets so as to permit of use of highly inflammable films on miniature type of machines will not be permitted.

7. Machines must be marked with the name or trade mark of the maker, and with the voltage and current rating for which they are designed, and be plainly marked, "For use with slow-burning films only."

(39) Outline Lighting:

(*Other than Signs on Exterior of Buildings.*)

(*a*) Must be connected only to low-potential systems.

(*b*) Conduit work or metal trough construction must be used, but wood moulding for such work is not hereby permitted.

(*c*) Where flexible tubing is required, the ends must be sealed and painted with moisture repellant and kept at least one-half inch from surface wired over.

(*d*) Wires for use in rigid or flexible steel conduit must comply with requirements for conduit work. Where armored cable is used, the conductors must be protected from moisture by lead sheath between armor and insulation.

(39) Outline Lighting—continued.

(*e*) Must be protected by its own cut-out, and controlled by its own switch; single pole switches must not be used. Cut-outs, switches, flashers and similar appliances must be of some approved type and be installed as required by the ordinance for such appliances, and, if outside the building, must, with the exception of transformer of weather-proof type, be installed in approved weather-proof cabinets.

(*f*) Circuits must be so arranged that not more than 1200 watts will be dependent upon one cut-out.

(*g*) Sockets and receptacles must be of the keyless porcelain type and wires must be soldered to lugs on same. Miniature receptacles will not be approved for outdoor work.

(*h*) Temporary open work, wires must be approved rubber covered, not less than No. 14 B. & S. gage and must be rigidly supported on incombustible, non-absorptive insulators, which separate the wires at least one inch from the surface wired over. Rigid supporting requires, under flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distance between supports must be shortened. In those parts of circuits where wires are connected to approved receptacles which hold them at least one inch from surface wired over, and which are placed not over one foot apart, such receptacles will be considered to afford the necessary support and spacing of the wires. Between receptacles more than one foot, but not more than two feet apart, an additional incombustible non-absorptive insulator maintaining a separation and spacing equivalent to the receptacle must be used. Except as above specified, wires must be kept apart at least two and one-half inches for voltages up to 300, and four inches for higher voltages.

(*i*) For metal trough construction, the troughs and other details must comply with the requirements of No. 83 (*a*) to (*f*) inclusive.

(40) *Left blank for future use.*

(41) Car Houses:

(*a*) The trolley wires must be securely supported on insulating hangers.

(*b*) The trolley hangers must be placed at such a distance apart that, in case of a break in the trolley wire, contact with the floor cannot be made.

(*c*) Must have an emergency cut-out switch located at a proper place outside of the building, so that all the trolley wires in the building may be cut out at one point, and line insulators must be installed, so that when this emergency switch is open, the trolley wire will be dead at all points within 100 feet of the building. The current must be cut out of the building when not needed for use in the building.

(This may be done by the emergency switch, or if preferred a second switch may be used that will cut all current from the building, but which need not cut out the trolley wire outside as would be the case with the emergency switch.)

If the feed to the car house is underground this emergency switch may be installed inside the building, but must be located at a point as near as practicable to where the underground feeder enters the building.

(*d*) All lamps and stationary motors must be installed in such a way that one main switch may control the whole of each installation lighting and power independently of the main cut-out switch called for in Section (*c*).

(*e*) Where current for lighting and stationary motors is from a grounded trolley circuit, the following special rules to apply:

1. Cut-out must be placed between the non-grounded side and lights or motors they are to protect. No set or group of incandescent lamps requiring over 2,000 watts must be dependent upon one cut-out.

2. Switches must be placed between non-grounded side and lights and motors they are to protect.

(41) Car Houses—continued.

3. All cut-outs and switches having exposed live metal parts must be located in cabinets. Cut-outs and switches not in iron boxes or in cabinets, must be mounted on not less than one-fourth inch fire-resisting insulating material, which must project at least one-half inch beyond all sides of the cut-out or switch.

4. Cut-out and switch cabinets must be substantially made of steel not less than one-sixteenth inch in thickness or of hard wood. For cabinets containing switches or cut-outs having exposed live metal parts, the entire inside, including the door, must be lined with an approved fire-resisting, insulating material not less than one-quarter inch thick, securely fastened and treated with a moisture repellant paint.

5. Must have all rails bonded at each joint with a conductor having a carrying capacity at least equivalent to No. 0 B. & S. gage annealed copper wire, and all rails must be connected to the outside ground return circuit by a not less than No. 0 B. & S. gage copper wire or by equivalent bonding through the track. All lighting and stationary motor circuits must be thoroughly and permanently connected to the rails or to the wire leading to the outside ground return circuit.

(*f*) All pendant cords and portable conductors will be considered as subject to hard usage.

(*g*) Must, except as provided in Section (*c*) have all wiring and apparatus installed in accordance with the rules for constant potential systems.

(*h*) Must not have any system of feeder distribution centering in the building, unless confined to a particular portion of the building and entirely enclosed by fireproof walls.

(*i*) Cars must not be left with the trolley in electrical connection with the trolley wire when in car houses.

(41A) Lighting and Power from Railway Wires:

Will not be permitted, under any pretense, in the same circuit with trolley wires with a ground return, except in electric car houses, power houses, passenger and freight stations connected with operation of electric railways.

(42) Garages:

For the purpose of the following a garage is considered as that building or portion of building which is designed for the use of, or those occupied for the storage, repair, or housing of automobiles when containing volatile or highly inflammable fuel; and all that portion of a building that is on or below the floor or floors on which such vehicles are kept which is not separated therefrom by tight unpierced fire walls and fire-resisting floors.

In addition to the general requirements of these regulations the following rules shall apply:

(*a*) In garages with sufficient floor area to permit the storage of one or more than two vehicles, as above, all conductors except those required for pendant lamps or portable connections must be installed in approved metal conduit or approved armored cable, except that approved metal raceways may be used only in offices and show rooms. Metal conduit, armored cable or metal raceways must be so installed that all outlet and junction boxes shall be located at least four feet above the floor. In garages used for one or two vehicles, as above, conduit or armored cable construction is required.

(*b*) Flexible cord for pendant lights must be approved reinforced cord.

(*c*) Flexible cord for portable lamps, motors or other apparatus must be approved cord designed for rough usage, preferably stage cable or packing house cord. The portable cord must carry the male end of an approved pin plug connector or equivalent, the female end being of such design or so hung that the connector

(42) Garages—continued.

will break apart readily at any position of the cable. The connector must be kept at least four feet above the floor.

(*d*) Flexible cable for charging must be of approved theatre stage type, this cable carrying parts of approved connectors of at least fifty amperes capacity. The connectors must be of such design or so hung that at least one will break apart readily at any position of the cable. Current-carrying parts of connectors must be shielded to prevent accidental contact. The fixed or wall connector, must be kept at least four feet above the floor, and if not located on switchboard or charging panel, must be protected against accidental contact.

(*e*) Cut-outs, switches and receptacles must be placed at least four feet above the floor except as provided in Section (*g*) below.

(*f*) All portable lights must be equipped with approved keyless sockets or moulded composition or metal-sheathed porcelain type. These sockets must be equipped with handles, hook and substantial guard.

(*g*) Switchboards and charging panels, at or upon which are mounted devices which in operation may produce a spark, must be located in a room or enclosure provided for the purpose unless all such spark producing devices are at least four feet above the floor or surrounded by vapor proof enclosures.

(*h*) Motors or dynamos, not actually a part of a vehicle, if not located at least four feet above the floor must be of the fully enclosed type. Motors located four feet or more above the floor if not of the fully enclosed type must be provided with wire screen of not less than No. 14 mesh over openings at commutator end.

(43) Electric Cranes:

All wiring, apparatus, and similar devices, not specifically covered by special rules herein given, must

(43) Electric Cranes—continued.

conform to the General Requirements of this ordinance, except that the switch required by No. 8 (*c*) for each motor may be omitted.

(*d*) **Wiring:**

1. All wires except bare collector wires, those between resistances and contact plates of rheostats and those subjected to severe external heat must be approved rubber covered and not smaller in size than No. 12 B. & S. gage. Insulation of wires between resistances and contact plates of rheostats must conform to Section (*d*) while wires subjected to severe external heat must have approved slow-burning insulation.

2. All wires excepting collector wires and those in metal conduit or approved flexible cable must be supported by knobs or cleats which separate them at least one inch from the surface wired over, but in dry places where space is limited and the distance between wires as required by No. 26 (*h*) cannot be obtained, each wire must be separately encased in approved flexible tubing securely fastened in place.

Collector wires must be supported by approved insulators so mounted that even with the extreme movements permitted the wires will be separated at all times at least 1½ inches from the surface wired over. Collector wires must be held at the ends by approved strain insulators.

3. Main collector wires carried along the runways must be rigidly and securely attached to their insulating supports approximately every 20 feet, and separated at least six inches when run in a horizontal plane; if not run in a horizontal plane, they must be separated at least eight inches. If spans exceeding 20 feet are necessary the distance between wires must be increased proportionately but in no case shall the span exceed 40 feet.

4. Where bridge collector wires are over 80 feet long, insulating supports on which the wires may loosely lie must be provided at least every 50 feet.

(43) Electric Cranes—continued.

Bridge collector wires must be kept at least 2½ inches apart, but a greater spacing shall be used whenever it may be obtained.

5. Collector wires must not be smaller in size than specified in the following table for the various spans:

Distance between rigid supports. Feet.	Size wire required. B. & S.
0 to 30	6
31 to 60	4
Over 60	2

(*b*) Collectors:

Must be so designed that sparking between them and collector wires will be reduced to a minimum.

(*c*) Switches and Cut-outs:

1. The main collector wires must be protected by a cut-out and the circuit controlled by a switch. Cut-out and switch to be so located as to be easy of access from the floor.

2. Cranes operated from cabs must have a cut-out and switch connected into the leads from the main collector wires and so located in the cab as to be readily accessible to the operator.

3. Where there is more than one motor on a crane, each motor with its leads must be separately protected by an automatic cut-out in accordance with No. 8 (*c*), except that where two motors operate a single hoist, carriage truck or bridge and are controlled as a unit by one controller, the pair of motors with their leads may be protected by a single automatic cout-out. The cut-out should be located in the cab when there is one.

(43) Electric Cranes—continued.

(*d*) Controllers:

Must be installed according to No. 4, except that if the crane is located out doors the insulation on wires between resistance and contact plates of rheostats must be rubber where the wires are exposed to moisture and insulation is necessary and also where they are grouped. If the crane operates over readily combustible material, the resistance must be placed in an enclosure made of incombustible material, thoroughly ventilated and so constructed that it will not permit any flame or molten metal to escape in the event of burning out the resistances. If the resistances are located in the cab, this result may be obtained by constructing the cab of incombustible material and providing sides which enclose the cab from its floor to a height at least 6 inches above the top of the resistances.

Batteries must be located in rooms or spaces having natural means of ventilation.

Battery jars and cells if not of insulating material such as glass or hard rubber shall be mounted on insulating supports of glass or porcelain.

(*e*) Grounding of Iron Work:

The motor frames, and entire frame of the crane and the tracks must be grounded as provided in Rule 15A.

HIGH-POTENTIAL SYSTEMS.

550 to 5,000 Volts.

Any circuit attached to any machine or combination of machines which develops a difference of potential between any two wires of over 550 *volts and less than* 5,000 *volts, shall be considered as a high-potential circuit, and as coming under this class, unless an approved transforming device is used which cuts the difference of potential down to* 550 *volts or less. For* 550 *volt motor equipment a margin of ten per cent. above the* 550 *volt limit will be allowed at the generator or transformer without coming under high-potential systems.*

(44) Wires:

(*See also Nos.* 16, 17, 18 *and* 20. *For construction rules see Nos.* 49 *and* 50.)

(*a*) Except in central stations, sub-stations and generator, transformer, switching and motor rooms, all apparatus and wiring connected to the high voltage circuits must be completely enclosed by substantial shields or casings, grounded as required in No. 15A, and the conduit must enter and be properly secured to such casing or to suitable terminal boxes secured or bolted to the casing. Generator, switching and motor rooms shall be securely locked, or other provisions shall be made to limit access only to qualified persons.

(*b*) The insulation of the several conductors where leaving the metal sheath of cables, must be thoroughly protected from moisture and mechanical injury by means of potheads or some similar method.

Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps.

(*c*) In central stations, sub-stations and generator, motor and transformer rooms conductors may be rigidly supported on glass or porcelain insulators

(44) Wires—continued.

which keep them at least one inch from the surface wired over and not less than eight inches apart, except at apparatus and devices. Rigid supporting requires supports about 4½ feet apart where wiring along flat surfaces under ordinary conditions.

(45) Transformers:

(*See also Nos.* 11 *and* 36. *For construction of Transformers see No.* 81.)

(*a*) Must be located as near as possible to the point at which the primary wires enter the building.

(*b*) The transformer cases must be permanently and effectively grounded and the enclosure in which the transformers are placed must be provided with a sewer connection or equipped with an incombustible sill at doorway of sufficient height to hold the oil of the transformers. The room must be of sufficient size to allow ample air space around the transformers. The ventilating system shall supply air to keep the temperature of the transformers in safe operating limits. The temperature of the room in no case should exceed 40 degrees Centigrade or 104 degrees Fahrenheit.

General installation requirements for transformers should be followed wherever practicable except that by special permission of the Inspector of buildings oil-filled transformers having a total or combined rating of 75 K. V. A. or less may be located in room of fire resisting construction if surrounded by concrete curbs not less than 6 inches high forming a basin of sufficient capacity to retain all of the oil used in all of the transformers surrounded.

(46) Series Lamps:

(*a*) No multiple series or series multiple system of lighting will be permitted.

(*b*) Must not, under any circumstances, be installed to gas fixtures.

EXTRA-HIGH-POTENTIAL SYSTEMS.

OVER 5,000 VOLTS.

Any circuit attached to any machine or combination of machines which develops a difference of potential, between any two wires of over 5,000 volts, shall be considered as an extra-high-potential circuit, and as coming under this class, unless an approved transforming device is used, which cuts the difference of potential down to 5,000 volts or less.

(47) Primary Wires:

Must not be brought into or over buildings, except power stations and sub-stations, except by special permission in writing by the Inspector of Buildings.

(48) *Left blank for future use.*

CLASS D.

FITTINGS AND MATERIALS.

ALL SYSTEMS AND VOLTAGES.

All the purposes of this rule, the descriptions contained in this section of the general characteristics of fittings and materials of the types commonly employed in electrical equipment for the installation of which regulations are given in Classes A, B, C, E and F, shall be taken as typical of and as a guide to the proper classifications and identifications of types, sizes, ratings and uses of fittings and materials together with such regulations as are applicable to all electrical devices.

The requirements for details of constructions and specifications for tests for which provisions are made in this section shall be taken as typical of and as a guide to the proper basis for standard practice in the installation of fittings and materials.

General:

Electrical fittings and materials for use under the installation regulations of these rules are to be taken with reference to the following five considerations which also determine the classifications by types, sizes, voltage, current-carrying capacities and specific uses.

(*a*) Suitability for installation and use in conformity with the regulations of these rules.

(*b*) Mechanical strength and durability including, for appliances designed to enclose and protect other equipment, the adequacy of the protection thus provided.

(*c*) Electrical insulation.

(*d*) Heating effects under normal conditions of use and also under abnormal conditions liable to arise in service.

(*e*) Arcing effects.

Bases:

Bases on which live parts are mounted must be made of approved incombustible, non-absorptive, insulating material.

The design of the base must be such that, considering the material used, the base will withstand the most severe conditions liable to be met in practice.

Bases with an area of over 25 square inches must have at least four supporting screws. Holes for supporting screws must be so located or counter sunk that there will be at least one-half inch space, measured over the surface between the screw-head or washer and the nearest live metal part and in all cases where between parts of opposite polarity must be counter-sunk.

Holes for supporting screws in link fuse cut-out bases must be kept outside the area included by the outside edge of the fuse terminals.

Nuts or screw heads on the under side of the base must be counter-sunk and sealed with a water-proof compound.

Terminal Parts:

Terminals parts by which wire connections are made must insure thoroughly good connections even under hard usage.

For currents above thirty amperes, lugs into which the connecting wires may be soldered or approved solderless connectors must be used.

For currents of 30 amperes and less the parts to which wiring connections are made must securely grip the conductors. Heavy clamps or screws with terminal plates having upturned lugs or approved solderless connectors may be used.

The set screws form of contact will not be approved.

Terminal Parts—continued.

Clamps or lugs are not required when leads are provided as a part of a device.

Markings:

The maker's name, trade-mark or other identification symbol must be placed on fittings and materials.

Markings giving voltage, current, wattage or other appropriate ratings are prescribed for many types of devices and must in general conform to the classification given in this section.

(49) Insulated Wires, Cables and Cords—Rules 49 to 57:

Wires, cables and cords of all kinds, except weather-proof wire must have a distinctive marking the entire length of the coil and must also be plainly tagged or marked so that they may be readily identified with the following indicative marking:

1. The maximum allowable working pressure or voltage.

(This may be omitted for slow-burning, slow-burning weather-proof, and weather-proof wires.)

2. The name of the manufacturing company and when desired, the trade name of the wire.

3. Month and year when manufactured.

4. The proper type letter for the particular style of wire or cable as given in the following rules for each type of insulation:

(50) Rubber-covered Wire not Fixture Wire:

Classification.

R.	Rubber Covered, single braided, for voltages	0—600
R-15	Rubber Covered, single braided, for maximum voltage	1500
R-25	Rubber Covered, single braided, for maximum voltage	2500
R-35	Rubber Covered, single braided, for maximum voltage	3500
R-50	Rubber Covered, single braided, for maximum voltage	5000
R-70	Rubber Covered, single braided, for maximum voltage	7000
R. D.	Rubber Covered, double braided	0—600
R. L.	Rubber Covered, sinble braided, leaded	0—600
R. D. L.	Rubber Covered, single braided, leaded	0—600
A. C.	Wires for use in Armored Cable	0—600
A. C. L.	Leaded Wires for use in Armored Cables	0—600

For type letters R. D.; R. L.; R. D. L.; A. C., and A. C. L. the voltage symbols, -15; -25; -35; -50, and -70 must be used respectively for the voltages 1500; 2500; 3500; 5000, and 7000 as provided in this classification for type letter R.

(*a*) Conductors:

No individual conductor, whether solid or stranded, shall be less than nominal No. 14 B. & S. gage.

All conductors and the individual wires of stranded conductors shall be tinned.

(*b*) Insulation:

Conductors shall be insulated for their entire length with a properly applied and properly vulcanized rubber compound.

The insulation must be of the nominal thickness given in the following table, the requirements of which vary according to the size of conductor and the maximum working pressure.

(50) Rubber Covered Wire not Fixture Wire—Con't.

TABLE OF THICKNESS OF RUBBER INSULATION FOR RUBBER COVERED WIRES AND CABLES IN 64TH OF AN INCH.

Size of Conductor.	Type Letters. For Working Pressures Not Over	R 600 Volts	R-15 1500 Volts	R-25 2500 Volts	R-35 3500 Volts	R-50 5000 Volts	R-70 7000 Volts
American or B. & S. Gauge.							
14 to 8		3	4	6	8	12	16
7 to 2		4	5	6	8	12	16
1 to 0000 C. M.		5	6	7	8	12	16
225,000 to 500,000		6	7	8	9	12	16
525,000 to 1,000,000		7	8	9	10	12	16
Over 1,000,000		8	9	10	11	14	18

(c) Coverings:

All single conductor rubber-insulated wires and cables must have a covering of fibrous material applied directly to the surface of the insulating wall.

For any single conductor wire there shall be at least one braid for sizes from No. 14 to and including No. 8. For all single conductor cables larger than No. 8 there must be at least two braids or a tape and a braid.

For twin wires and twisted pair wires and for all multiple conductor cables there shall be a fibrous covering on each individual wire and in addition a braid enclosing the bunched conductors.

For certain special service conditions, one or more additional coverings of fibrous material or of lead are required.

(50) Rubber Covered Wire not Fixture Wire—Con't.

Fibrous coverings may be either braid or tape but tape shall not be used for the outer covering. All braids must be impregnated with a moisture-proof compound.

Lead covering may be applied to single or multiple conductors. Lead covered multiple conductor cable with more than two conductors must, in all cases, have the conductors spirally laid.

In all cases, the individual conductors in lead covered cable must have a fibrous covering, and, except for two conductor cables, with conductors parallel, there must be a fibrous covering over bunched conductors.

(51) Flexible Cords:

(For installation rules see No. 32. For Cords for Portable Heating Apparatus see Section (i).

(*a*) Must comply with the requirements of No. 49 (*a*) and (*b*).

(*b*) **Conductors:**

Each conductor must have a carrying capacity not less than that of a No. 18 B. & S. gage wire.

(*c*) **Insulation:**

The insulation must consist of properly applied and properly vulcanized rubber compound of the nominal thickness given in the following table:

B. & S. Gage.	Thickness, Inches.
14 to 8	3/64
18 and 16	1/32

(For exception see Type Letter P. S. below (*No. 51 f.*)

(*d*) **Coverings:**

Each conductor must be covered with a tight, close wind of fine cotton, or some other method must be employed to prevent a broken strand puncturing the insulation.

Use.	Type.	Trade Name.	Braid on Each Conductor.	Reinforcement or Filler.	Outer Cover.	See Also
As Pendants or Portables in Dry Places						
Where Not Subject to Hard Usage	C	Lamp Cord	Cotton or Silk			51e
	PD	Twisted Portable	Cotton or Silk		Cotton or Silk	51f
	PO	Parallel Cord	Cotton or Silk		Cotton or Silk	51f
For Hard Usage	P	Reinforced Cord	Cotton or Silk	Rubber Jacket	Cotton or Silk	
	CA	Armored Cord	Cotton or Silk		Armor	
	PA	Armor Reinf. Cord	Cotton or Silk	Rubber Jacket	Cotton and Armor	
Pendants Damp Places	CB	Brewery Cord	Cotton Wp			51e
	CC	Canvasite Cord	Cotton Wp		Cotton Wp	51e
Portable Damp Places	PWp	Reinf. Cord Wp	Cotton	Rubber Jacket	Cotton Wp	
	PkWp	Packing House Cd	Cotton	Filler	2 Cotton both Wp	
	PAWp	Arm. Reinf. Cord Wp	Cotton	Rubber Jacket	Cotton Wp and Armor	
Theatre Stages	T	Stage Cable	Cotton Wp	Filler	2 Cotton both Wp	51g
Theatre Border	B	Border Light Cable	Cotton Wp		2 Cotton both Wp	
Elevator Lighting and Control	E	Elevator Cable	Cotton	Rubber Jacket and or	1 or more Cotton Both Wp 3 Cotton, outer one Wp	51h

(51) Flexible Cords—continued.

(*e*) (Type Letters C, CB and CC.) In these classes are included flexible cords which under usual conditions hang freely in air.

(*f*) (Type Letters PO and PS.) These cords are for use only in offices, dwellings or similar places where not liable to rough usage.

For Type PO the conductors may be either laid parallel or twisted together.

Type PS cord may be made only with conductors of No. 18 or No. 16 B. & S. gage and may have insulation not less than one sixty-fourth inch in thickness.

(*g*) (Type Letter T.) Shall consist of not more than three conductors, each not exceeding No. 4 B. & S. gage twisted together and with a filler. The insulation on each conductor of No. 6 to No. 4 B. & S. gage shall be not less than one-sixteenth inch in thickness.

(*h*) (Type Letter E.) Conductors for elevator lighting cables shall not be smaller than No. 14 and for elevator control cables not smaller than No. 16 B. & S. gage.

(*i*) For Portable Heating Apparatus:: (Type Letter H.)
This cord is for use with all smoothing and sad irons and with other heating devices requiring over 250 watts.

1. Must comply with the requirements of Nos. 49 (*a*), (*b*) and 51 (*b*).

2. The covering may consist of a layer of rubber or other approved material, a braided covering of asbestos and an outer braid enclosing either all the conductors as a whole or each conductor separately.

3. Other types of coverings must be the equivalent in all respects to those given and meet the approval of the Inspector of Buildings.

(52) Fixture Wires:

(For installation rules see Nos. 30 and 35. For construction of fixtures see No. 77.)

(*a*) Fixtures may be wired with approved flexible cord or approved rubber covered wire.

In wiring certain fixtures (see Nos. 30 (*c*), 35 and 77 (*c*) wires having approved slow-burning or other heat-resisting coverings must be used.

For other wires for use in fixtures the following rules apply. (Types Letters F-64, F-32.)

(*b*) Must comply with the requirements of No. 49 (*a*) and (*b*).

(*c*) **Conductors:**

May be either solid or stranded and must not be smaller than No. 18 B. & S. gage.

If stranded conductor is used each conductor must be covered with a tight close wind of fine cotton or some other method must be used to prevent a broken strand puncturing the insulation. Solid conductors must be tinned.

(*d*) **Insulation:**

The insulation must consist of properly applied and properly vulcanized rubber compound.

The thickness of insulation shall not be less than one sixty-fourth inch for No. 18 B. & S. gage wire and not less than one thirty-second inch for No. 16 B. & S. gage.

(*e*) **Coverings:**

Shall be of braided cotton or silk or of other approved material and shall be sufficiently tenacious to withstand abrasion when being pulled into fixtures.

(53) Conduit Wires:

(*For installation rules see No.* 26 (*n*) *to* (*p*).

For conduit work wires of Type Letters R. (No. 14 to No. 8 incl.) RD, RL, or RDL may be used.

(54) Armored Cable and Cord:

(Type Letters AC, CA, PA and PAWp.)

(*For installation rules for Armored Cable see No.* 27. *for armored cord see No.* 32 (*e*) *and No.* 51.)

(*a*) The conductors must comply with the requirements for rubber-covered wires of cord of the specified types and construction.

(*b*) The cable or cord must have a distinctive marker its entire length.

(55) Slow-burning Weatherproof Wires:

(Type Letters S. B. W.)

(*For installation rules see No.* 26 (*h*).

(*a*) The insulation must consist of two coating, one to be fire-proof and the other weather-proof. The fire-proof coating must be on the outside and must comprise about six-tenths of the total thickness of the wall. The thickness of the completed covering shall be not less than that specified for rubber insulation of 0-600 volt rubber covered wires. (See No. 50 (*b*).

(*b*) Must comply with the requirements of No. 49 (*a*) and (*b*).

(56) Slow-burning Wire:

(Type Letters S. B.)

(*For installation rules see No.* 26 (*g*) *and* (*h*).

This insulation must be used in hot, dry places where ordinary insulations would perish, and where wires are

(56) Slow-burning Wire—continued.

bunched as on the back of a large switch-board or in a wire tower, where the accumulations of rubber insulation would result in an objectionable large mass of highly inflammable material.

Slow-burning conductors especially designed and approved for use in fixtures (see No. 52 (*a*) need not necessarily comply with the following requirements.

(*a*) The insulation must consist of three braids of cotton or other thread all the interstices of which must be filled with materials having fire resisting and insulation properties. Its surface must be finished smooth and hard.

The thickness of the completed covering shall be not less than that specified for the rubber insulation of 0-600 volt rubber covered wires. (See No. 50 (*b*).

(*b*) Must comply with requirements of No. 49 (*b*).

(57) Weatherproof Wire:

(Type Letters W. R.)

(For rules for installation see No. 26 (i) and (j).

This wire is for outside use only, where moisture is certain and where fireproof qualities are not necessary.

(*a*) The insulating covering shall consist of at least three braids, all of which must be thoroughly saturated with a dense moisture-proof compound.

The thickness of the completed covering shall be not less than that specified for the rubber insulation of 0-600 volt rubber-covered wires. (See No. 50 (*b*).

(*b*) Must comply with requirements of No. 49 (*b*).

(58) Metal Conduits:

(For installation rules see Nos. 26 (n) to (p), 28 and 40 (d.)

(*a*) All surfaces of the tube, elbows, bends and similar fittings must be protected in an approved manner against corrosion.

(58) Metal Conduits—(Continued).

(*b*) Finished rigid conduit as shipped must be in ten-foot lengths, with each end reamed and threaded. For each length at least one coupling must be furnished. It must have an approved interior coating of a character and appearance which will readily distinguish it from ordinary commercial pipe commonly used for other than electrical purposes.

(*c*) Cable known to the trade as "BX and BXL Cable" must not be installed where exposed to moisture, and in no case will it be permitted plastered in on brick, stone or cement walls.

(59) Outlet, Junction and Flush Switch Boxes:

(*For installation rules see Nos.* 27 *and* 28. *For boxes for panel-boards, cut-outs and switches other than snap switches see No.* 70.)

(*a*) Junction or pull boxes not over 150 cubic inches in size, outlet and flush switch boxes must be pressed steel not less than 0.078 inch (No. 14 U. S. sheet metal gage), or of cast metal having wall thickness not less than ⅛ inch.

Junction or pull boxes of over 150 cubic inches in size must be of metal and must comply with the detailed specifications for cut-out boxes (see No. 70) except that the covers may be single flat sheets secured to the box proper by screws or bolts instead of hinges, if desired. Boxes having covers of this form are for use only for enclosing joints in conductors or to facilitate the drawing in of wires and cables and not for use in enclosing switches, cut-outs or other forms of control devices.

(*b*) Must be well galvanized, or coated with tin or zinc, or enameled, or otherwise properly coated inside and out with some conductive material in such a manner as to prevent oxidation.

(*c*) Must be so made that all openings not in use will be effectively closed by metal which will afford protection substantially equivalent to the walls of the box.

(59) Outlet, Junction and Flush Switch Boxes—Con't.

Fittings including conduit box covers designed for bringing conductors other than flexible cords or for pendants from metal conduit to exposed wiring must be provided with non-absorptive, incombustible, insulating bushings, which, except with flexible cord, must separately insulate each conductor. For flexible cords or for pendants such fittings, including covers of outlet boxes, must be provided with approved bushings or must have smooth, well-rounded surfaces on which the cords shall bear.

(*d*) Must, in case of combination gas and electric outlets be so arranged that connection with gas pipe at outlet may be made by means of an approved device. Fixture studs where not a part of the box must be made of mallable iron or other approved material of like nature.

Conduit or flexible tubing entering the boxes must be firmly secured in position by means of some approved device which may or may not be a part of the box.

(*e*) Switch and outlet boxes must be so arranged that they can be securely fastened in place independently of the support afforded by the conduit piping, except that when entirely exposed approved boxes, which are threaded so as to be firmly supported by screwing on the conduit, may be used.

(*f*) Switch and receptacle boxes must completely enclose the switch or receptacle on sides and back, and must provide a thoroughly substantial support for it. The retaining screws for the box must not be used to secure the switch in position. Boxes for floor outlets shall be designed to completely enclose the receptacle and attachment plugs, if any, to protect them from mechanical injury and to exclude moisture.

(*g*) Covers for outlet boxes if made of metal must be equal in thickness to that specified for the walls of the box, or must be of metal lined with an insulating material not less than one-thirty-second inch in thick-

(59) Outlet, Junction and Flush Switch Boxes—Con't.

ness, firmly and permanently secured to the metal. Covers may also be made of porcelain or other approved material, provided they are of such form and thickness as to afford suitable protection and strength. Flush switch and receptacle plates of metal shall be at least .040" in thickness.

(60) Raceways for Surface Wiring:

(For installation rules see Nos. 26 (k) to (m).

Wooden Raceways:

(a) Must be made in two pieces, a backing and a capping, and must afford suitable protection from abrasion. Must be so constructed as to thoroughly encase the wire, be provided with a tongue not less than one-half inch in thickness between the conductors, and have exterior walls which under grooves shall not be less than three-eighths, and on the side not less than one-fourth inch in thickness.

Metal Raceways:

(For installation rules see Nos. 26 (k) to (m).

(c) Must be constructed in a manner to distinguish them from metal conduit.

(d) All surfaces of the raceway elbows, bends and similar fittings must be protected in an approved manner against corrosion.

(e) The raceways and all elbows, couplings and similar fittings must be so made and installed as to secure the sections together both mechanically and electrically and protect the conductors from abrasion. Holes for screws or bolts inside the raceways must be arranged so that when screws or bolts are in place the heads will be flush with the metal surface.

(61) Cleats, Knobs, Tubes and Bushings:

(*a*) Must be made of approved incombustible, non-absorptive insulating material, free from checks, rough projections or sharp edges which might injure the insulation of the wire.

(*b*) For wires larger than No. 4 B. & S. gage split knobs (single wire cleats) must have provision for two supporting screws.

(*c*) **Spacing:**

At least one-fourth inch separation must be maintained between the supporting screw or nail and the conductor.

Cleats must conform to the specifications given in the following table:

Voltage.	Distance from wire to surface.	Distance between wires.
0-300	½ inch	2½ inches

Knobs must be so constructed as to separate the wire at least one inch from the surface wired over.

(*d*) **Dimensions:**

For tubes and bushings the dimensions of walls and heads must be at least as great as those given in the following table:

Diameter of Hole.	External Diameter.	Thickness of Wall.	External Diameter of Head.	Length of Head.
5/16 in.	9/16 in.	⅛ in.	13/16 in.	½ in.
⅜ in.	11/16 in.	5/32 in.	15/16 in.	½ in.
½ in.	13/16 in.	5/32 in.	1 3/16 in.	½ in.
⅝ in.	15/16 in.	5/32 in.	1 5/16 in.	½ in.
¾ in.	1 3/16 in.	7/32 in.	1 11/16 in.	⅝ in.
1 in.	1 7/16 in.	7/32 in.	1 15/16 in.	⅝ in.
1¼ in.	1 13/16 in.	9/32 in.	2 5/16 in.	⅝ in.
1½ in.	2 3/16 in.	11/32 in.	2 11/16 in.	¾ in.
1¾ in.	2 9/16 in.	13/32 in.	3 1/16 in.	¾ in.
2 in.	2 15/16 in.	15/32 in.	3 7/16 in.	¾ in.
2¼ in.	3 5/16 in.	17/32 in.	3 13/16 in.	1 in.
2½ in.	3 11/16 in.	19/32 in.	4 3/16 in.	1 in.

An allowance of one-sixty-fourth of an inch for variation in manufacturing will be permitted, except in the thickness of the wall.

(61) Cleats, Knobs, Tubes and Bushings—continued.

Knobs must be constructed to conform to the following minimum dimensions:

Size of Wire Inclusive.	Size of Base, Inches.			Solid Knobs, Groove, Inches.		Split Knob, Thickness of Cap, Inches from Top of Wire, Groove.
	Circular Knobs, Diameter.	Square Knobs or Single Wire Cleats.		Depth.	Diameter.	
		Width.	Length.			
14-10	1 1/8	3/4	1 3/4	3/16	1/4	3/8
8-4	1 1/2	7/8	2	5/16	5/16	5/8
2-00	2	1	2 1/4	7/16	5/8	5/8
000-300,000 C. M.	2 1/2	1 1/8	2 3/4	7/16	25/32	7/8
400,000-1,000,000 C. M.	3	1 3/8	3 3/4	5/8	1 1/4	1

(62) *Left blank for future use.*

(63) Flexible Tubing:

The tubing must have a smooth interior, and its outer surface must be treated with a moisture repellant and must not convey fire when ignited and held in a vertical position. The tubing must be so designed that the interior lining, if any, is not removable in lengths of over three (3) feet and be sufficiently tough and tenacious to withstand any abrasion likely to be met with in practice.

(64) *Left blank for future use.*

(65) Switches:

(*For installation rules see Nos.* 8 (*c*), 19, 20 (*b*) *and* 24.)

(A knife switch is a switch having electrical connecting parts in form of hinged or pivoted bars or blades and designed for manual operation.)

Under this term are included single or multiple pole switches either with or without fuse terminals, switches having individual bases designed for either front or rear wiring connections; also switch parts without separate bases intended for mounting on switchboards and panel boards.

(*a*) Classification and Marking:

Must be plainly marked where it can be read when the switch is installed with the current and the voltage for which the switch is designed as follows:

Classification. (30 to 1,000 amperes inclusive.)	Markings.
125 V. D. C. or A. C. Only for switchboards and panel boards. (with or without fuses)	125 V. Amps.
250 V. D. C. or 500 V. A. C. (without fuses)	250 V. D. C. 500 V. A. C. Amps.
250 V. D. C. or A. C. (with fuses)	250 V. Amps.
500 V. A. C. (with 600-volt fuses)	500 V. A. C. Amps.
600 V. D. C. or A. C. (with or without fuses)	600 V. Amps.
Triple-pole; with 125 volt	126 V. Amps.
Spacing between blades for use on three-wire systems having 125 volts between adjacent wires and not over 250 volts between adjacent wires and not over 500 volts between outside wires.	

(*b*) Mounting:

Pieces carrying or used to hold the break and hinge jaws must be secured to the base or mounting surface in such a manner as to prevent possible turning.

(65) Switches—continued.

The cross bar must be secured to each blade in such a manner as to prevent turning and twisting.

(c) **Spacings:**

The spacing given below are standard and are to be considered as the minimum allowable. except as otherwise provided for.

The measurements given under Tables 1 and 2 are to be taken within the area of the switch base bounded by the contact parts of the switch mechanism (break and hinge jaws). The measurements outside of the zone of the switch mechanism shall not be less than given under Table 3.

The dimensions given for break distances do not apply to quick break attachments on switch mechanisms.

TABLE 1.

For Switchboards and Panels Only.

	125 V., D. C. or A. C.	
Ampere Rating.	Opposite Polarity.	Break Distance
30	1	¾
60	1¼	1

TABLE 2.

For All Other Switches.

	125V.,D.C. or A.C.		250V.,D.C. or A.C.	
Ampere Rating.	Opp. Pol.	Break.	Opp. Pol.	Break.
30	1¼	1	1¾	1½
60	1½	1¼	2¼	2
100	1½	1¼	2¼	2
200 and 300	2¼	2	2½	2¼
400 and 600	2¾	2½	2¾	2½
800 to 6000 incl.	3	2¾	3	2¾

(65) Switches—continued.

	500V., A.C.		600V., D.C. or A.C.	
Ampere Rating.	Opp. Pol.	Break.	Opp. Pol.	Break.
30	2¼	2	4	3½
60	2¼	2	4	3½
100	2¼	2	4½	4
200 and 300	2½	2¼	4½	4
400 and 600	2¾	2½	4½	4
800 to 6000 incl.	3	2¾	4½	4

300 ampere switches are to be used only on switchboards.

TABLE 3.

Spacings between Parts of Opposite Polarity outside the area bounded by the contact parts of the switch mechanism (except Link Fuses).

Switches above 1000 amperes capacity must not be used to break currents but only as disconnecting switches.

When Mounted on Same Surface.	When Clear of Surface.
Not over 125 V. ¾ inch	½ inch
Not over 250 V. 1¼ inch	¾ inch
Not over 600 V. 2 inch	1¾ inch

(*d*) Fuse Terminals:

When fuse terminals are provided the spacings for such terminals required by Rules 67 (*a*) and 68 (*g*) must be provided.

Switches rated above 600 amperes at 250 volts and 400 amperes at 600 volts, and therefore exceeding the capacities of standard sizes of cartridge enclosed fuses, may be arranged for fuses in multiple, provided as few fuses as possible are used, that the fuses are of equal capacity and provided that the multiple terminals for each pole are mounted in common.

Switches having fuse terminals and intended for use in the ultimate or branch circuits indirect connection with lamp or other translating devices, must have fuse terminals in each pole.

(65) Switches—continued.

(*e*) Auxiliary Contacts:

Auxiliary contacts of a renewable or quick-break type or the equivalent are recommended for D. C. switches rated at over 250 volts and must be provided on all 600 volt switches designed for use in breaking currents from 200 to 1000 amperes inclusive.

(*f*) Barriers:

Barriers designed to be placed between the poles and switches and not located within the influence of the arc must be of non-absorptive insulating material. Barriers placed between the poles of switches and located within the influence of the arc formed by the opening of the switch must be of an incombustible, non-absorptive, insulating material.

Barriers, designed to be placed between poles of switches as hinge jaws must be of such a size and so located as to provide a separation between contact parts measured in the shortest insulating surface path over the barrier equal to that required for switches without barriers, and to provide a separation between other current-carrying parts, as given under "Spacing."

Barriers placed between the poles of switches at the break jaws, and, therefore located within the influence of the arc formed by the opening of the switch, must be of such a size and so located as to provide a separation between contact parts measured in the shortest path through air over the barrier equal to that required for switches without barriers.

(*g*) Multiple Pole Switches:

Switches designed for double throw and having three or more poles, must not have front-connected terminals for the hinge contacts of the inner poles, unless standard switch spacings between adjacent live metal parts of opposite polarity are secured either by increased spacing between poles or by the use of barriers as provided for in Section (*f*).

(66) Circuit Breakers:

Automatic overload circuit breakers must be substantial in construction, and must have ample metal for stiffness. The contact parts shall be arranged so that thoroughly good bearings are obtained. All breakers must be provided with easily accessible means of tripping them by hand without injury to the operator.

(67) Cut-out Bases:

(*For installation rules see Nos.* 8 (*c*), 19, 23, 25 (*a*), 33 (*a*) *and* 42.)

These requirements do not apply to rosettes, attachment plugs and protective devices for signaling systems.

Link Fuse Cut-out Bases:

(*a*) Spacings:

Spacing must be at least as great as those given in the following table, which applies only to plain, open fuse blocks, mounted on slate or marble bases. If the copper fuse-tips overhang the edges of the fuse-block terminals, the spacings must be measured between the nearest edges of the tips.

Ampere Capacity.	Minimum Separation of Nearest Metal Parts Opposite Polarity.	Minimum Break Distance.
Not over 125 Volts.		
0-10	¾ inch	¾ inch
11-100	1 inch	¾ inch
101-300	1 inch	1 inch
301-1000	1¼ inch	1¼ inch
Not over 250 volts		
0-10	1½ inch	1¼ inch
11-100	1¾ inch	1¼ inch
101-300	2 inch	1½ inch
301-1000	2½ inch	2 inch

(67) Cut-out Bases—continued.

A space must be maintained between fuse terminals of the same polarity of at least one-half inch for voltages up to 125 and of at least three-quarter inch for voltages from 126 to 250. This is the minimum distance allowable and greater separation should be provided when practicable.

For 3-wire systems cut-out must have the break distance required for circuits of the potential of the outside wires, except that in 125-250 volt system with grounded neutral the cut-outs in 2-wire 125-volt branch circuits may have the same spacing as specified for not over 125 volts.

Enclosed Fuse Cut-out Bases—Plug and Cartridge Type:

(*b*) Fuse Terminals:

Except for sealable service and meter cut-outs fuse terminals must be of either the Edison plug; spring clip or knife blade type, to take the corresponding standard enclosed fuses. They must be secured to the base by two screws or equivalent, so as to prevent them from turning, and must be so made as to secure a thoroughly good contact with the fuse. End stops must be provided to insure the proper location of the cartridge fuse in the cut-out base.

(*c*) Classification:

Must be classified as regards both current and voltage as given in the following table, and must be so designed that the bases of one class cannot be used with fuses of another class rated for a higher current or voltage.

Standard Plug or Cartridge Cut-outs.

Not Over 250 Volts.	Not Over 600 Volts.
0-30 amperes	0-30 amperes
31-60 amperes	31-60 amperes
61-100 amperes	61-100 amperes
101-200 amperes	101-200 amperes
201-400 amperes	201-400 amperes
401-600 amperes	

(67) Cut-out Bases—continued.

Sealable Service and Meter Cut-outs.

Not Over 250 Volts.	Not Over 600 Volts.
0-30 amperes	0-30 amperes
31-60 amperes	31-60 amperes
61-100 amperes	61-100 amperes
101-200 amperes	101-200 amperes

(68) Fuses:

(*For installation rules, see Nos.* 8 (*c*), 19, 23, 25 (*a*) *and* 33 (*a*).

Link Fuses:

(*a*) **Contact Tips:**

Contact surfaces or tips must be of copper or aluminum, having perfect electrical connections with the fusible part of the strip.

(*b*) **Rating:**

Link fuses must be stamped with 80 per cent of the maximum current which they can carry indefinitely, thus allowing about 25 per cent. overload before the fuse melts.

Enclosed Fuses—Plug and Cartridge Type:

These requirements do not apply to fuses for rosettes, attachment plugs and protective devices for signaling systems.

(*c*) **Construction:**

The fuse casing must be sufficiently tight so that lint and dust cannot collect around the fusible link and become ignited when the fuse is blown.

The fusible wire must be attached to the terminals in such a way as to secure a thoroughly good connection.

Non-refillable fuses must be discarded when blown. Refillable cases must be refilled with a proper capacity fuse.

(68) Fuses—continued.

(*d*) **Classification:**

Must be classified to correspond with the different classes of cut-outs, and must be so designed that it will be impossible to put any fuse of a given class into a cut-out which is designed for a current or voltage lower than that of the class to which the fuse belongs.

(*e*) **Marking:**

The tube or ferrules of ferrule contact fuses and the tubes or caps of knife-blade fuses shall be marked with the labeled capacity.

In addition to the above marking each fuse must be provided with a paper label—green for 250 volt fuses and red for 600 volt fuses.

The label must bear the following: The name or trade-mark of the manufacturer and the voltage for which the fuse is designed.

Must be marked with the words "N. E. Code Std." All fuses shall be marked with the ampere capacity on ferule contact fuses, this marking shall be on the tube or ferrules, and on knife blade fuses on the tubes or caps.

In addition to the above marking each cartridge enclosed fuse shall be provided with a paper label, red for 600 volt fuses, yellow or orange for 250 volt fuses of 15 amperes or less capacity and green for fuses of over 15 amperes capacity.

Plug fuses of 15 amperes capacity or less shall be distinguished from those of larger capacity as follows: By an hexagonal opening in the brass cap through which the mica or similar window shows; or by a hexagonal shaped recess in the top of fuses having porcelain or moulded composition top, and when labels are used with such plug fuses the labels shall also be hexagonal in shape and fill the recess; or on plugs having solid metal caps, by an hexagonal impression either raised or lowered on the caps.

(68) Fuses—continued.

(*f*) **Terminals:**

The fuse terminals muse be sufficiently heavy to insure mechanical strength and rigidity. The styles of terminals, except for use in sealable service and meter cut-outs, must be as follows:

Not over 250 volts.

0-30 Amps.	A. Cartridge fuse (ferrule contact.) B. Approved plugs or cartridge fuses in properly designed casings, for Edison plug cut-outs not exceeding 125 volts, but including any circuit of a three-wire 125-250-volt system with grounded neutral.
31-60 Amps.	Cartridge fuse (ferrule contact) for use also in properly designed casings for large size Edison plug type 250-volt cut-outs.
61-100 Amps. 101-200 Amps. 201-400 Amps. 401-600 Amps.	Cartridge fuse (knife blade contact).

Not over 600 volts.

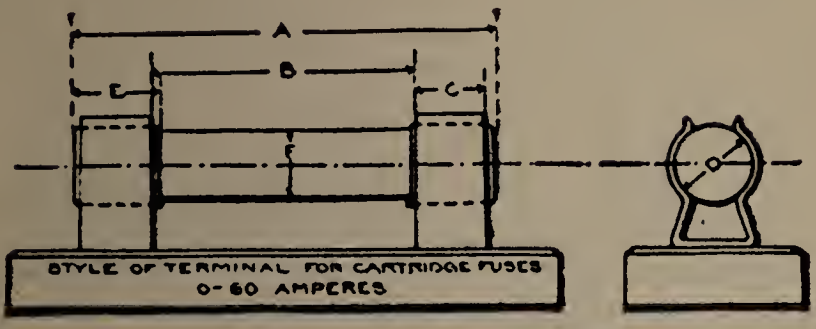
0-30 Amps. 31-60 Amps.	Cartridge fuse (ferrule contact).
61-100 Amps. 101-200 Amps. 201-400 Amps.	Cartridge fuse (knife blade contact).

(*g*) **Dimensions:**

Cartridge enclosed fuses and corresponding cut-out bases, except for sealable service and meter cut-outs must conform to the dimensions given in the table attached:

(68) **Fuses—continued.**

TABLE OF DIMENSIONS OF THE STANDARD CARTRIDE.

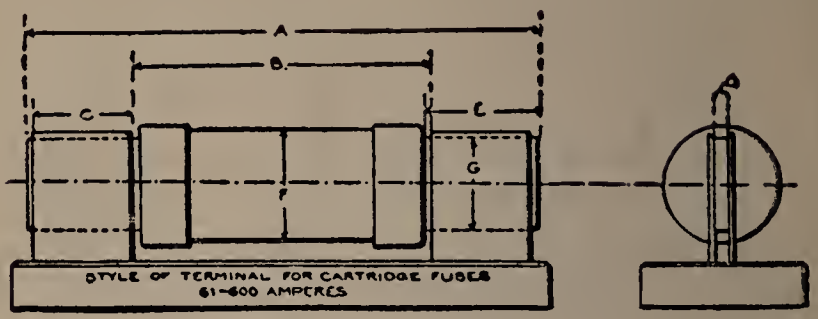


Form 1. CARTRIDGE FUSE—Ferrule Contact.

Voltage.	Rated Capacity, Amperes.	A		B	C
			Lengths Over Terminals. Inches.	Distance Between Contact Clips, Ins.	Width of Contact Clips, Ins.
Not Over 250	0-30	Form 1	2	1	½
	31-60		2	1¾	⅝
	61-100	Form 2	5⅞	4	⅞
	101-200		7⅛	4½	1¼
	201-400		8⅝	5	1¾
	401-600		10⅜	6	2⅛
Not Over 600	0-60	Form 1	5	4	½
	31-60		5½	4¼	⅝
	61-100	Form 2	7⅞	6	⅞
	101-200		9⅝	7	1¼
	201-400		11⅝	8	1¾

(68) Fuses—continued.

NATIONAL ELECTRICAL CODE ENCLOSED FUSE.



Form 2. CARTRIDGE FUSE—Knife Blade Contact.

D	E	F	G		
Diameter of Ferrules or Thickness of Terminal Blades, Inches.	Minimum Length of Ferrules or of Terminal Blades Outside of Tube, Inches.	Diameter of Tube, Inches.	Width of Terminal Blades, Inches.		Rated Capacity, Amperes.
9/16	½	½		Form 1	0-30
13/16	⅝	¾			31-60
⅛	1	1	¾	Form 2	61-100
3/16	1 ⅜	1 ½	1 ⅛		101-200
¼	1 ⅞	2	1 ⅝		201-400
¼	2 ¼	2 ½	2		401-600
13/16	½	¾		Form 1	0-30
1 1/16	⅝	1			31-60
⅛	1	1 ¼	¾	Form 2	61-100
3/16	1 ⅜	1 ¾	1 ⅛		101-200
¼	1 ⅞	2 ½	1 ⅝		201-400

(69) Panel Boards:

The following regulations shall apply to all panel and distributing boards used for the control of light and power circuits, but not to such switch boards in central stations, sub-stations or isolated plants as directly control energy derived from generators or transforming devices.

(*a*) Design:

The regulations for construction of switches and cutouts (see Nos. 65 and 67) must be followed as far as they apply.

In the relative arrangement of fuses and switches, the fuses may be placed between the bus-bars and the switches, or between the switches and the circuits except in the case of service switches, when No. 23 (*a*) must be complied with. When the branch switches are between the fuses and bus-bars, the connections must be so arranged that the blades will be dead when the switches are open.

When there are exposed live metal parts on the back of board, a space of at least one-half inch must be provided between such live metal parts and the cabinet in which the board is mounted.

(*b*) Spacing:

The following minimum distance between bare live metal parts (bus-bars, and similar appliances) must be maintained:

	Between parts of opposite polarity except at switches and link fuses.		
	When mounted on the same surface.	When held free in air.	At link fuses.
Not over 125 volts..	¾ in.	½ in.	½ in.
Not over 250 volts..	1¼ in.	¾ in.	¾ in.
Not over 600 volts..	2 in.	1¾ in.	1 in.

(69) Panel Boards—continued.

At switches or enclosed fuses, parts of the same polarity may be placed as close together as convenience in handling will allow.

The spacings given in the first column apply to the branch conductors where enclosed fuses are used. Where link fuses or knife switches are used, the spacing must be at least as great as those required by Nos. 65 and 67.

The spacings given in the second column apply to the distance between the raised main bars and between these bars and the branch bars over which they pass. The spacings given in the third column are to prevent the melting of a link fuse by the blowing of an adjacent fuse of the same polarity.

(70) Cabinets and Cut-out Boxes:

(For Cut-outs, Switches, Circuit Breakers, Feeder Circuit Branch Panel Boards and similar devices. For installation rules see Nos. 19 (*b*), (*e*) *and* 23 (*c*).

(*a*) Cabinets are designed either for surface or for flush mounting and are provided with frames, matts or trims, in which swinging doors are hung.

Cut-out boxes are designed for surface mounting and have swinging doors or covers secured directly to and telescoping with the walls of the box proper.

Cabinets or cut-out boxes intended for installation out-of-doors must be of weather proof type.

(*b*) Cabinets and cut-out boxes, when used to enclose devices or apparatus connected within the cabinet or cut-out box to the wires of more than four circuits not including the supply circuit or a continuation thereof, must have back wiring spaces or one or more side wiring spaces, side gutters or wiring compartments unless the wires leave the cabinet or cut-out box directly opposite their terminal connections.

(70) Cabinets and Cut-out Boxes—continued.

(*c*) Design and construction of all cabinets and cut-out boxes must be such as to insure ample strength and rigidity.

(*d*) The spacing within cabinets and cut-out boxes must be sufficient to provide ample room for the distribution of wires and cables placed in them, and for a separation between metal parts or cabinets or cut-out boxes and current carrying parts of devices and apparatus mounted within them as follows:

1. There must be an air space of at least 1/16 inch except at points of support, between the base of the device and the wall of any metal cabinet or cut-out box on which the device is mounted.

2. There must be an air space of at least one inch between any enclosed fuse or current carrying part and the door unless the door is lined with an approved insulating material or is of a thickness at least that of No. 12 U. S. gage when the air space must not be less than one-half inch.

3. There must be a space of at least two inches between open link fuses and metal lined walls or metal lined or glass penaled doors.

4. Except as noted above there must be an air space of at least one-half inch between the walls, back, gutter partition, if of metal, or door of any cabinet or cut-out box and the nearest exposed current carrying part of devices mounted within the cabinet where the potentials do not exceed 250 volts. This spacing must be increased to at least one inch where potential exceed 250 volts.

5. Cabinets and cut-out boxes must be deep enough to allow doors to be closed when 30 amperes branch circuit panel board switches having spool or composition handles or when switches of combination cut-outs are in any position and when other single throw switches are thrown open as far as their construction and installation will permit.

(70) Cabinets and Cut-out Boxes—continued.

6. Cabinets having one or more side wiring spaces, side gutters or side wiring compartments must be furnished with covers, barriers or partitions extending around or from the side or sides of all bases or groups of bases of the switches, cut-outs, circuit breakers or feeder, and circuit branch panel board within the cabinet and providing a close fit with the door, frame or sides of the cabinet so as to inclose these spaces, gutters or compartments and the wires stowed within them. At sides where wires or cables are led from the cabinet at points directly opposite their terminal connection to devices or apparatus within the cabinet, and other wires or cables are not placed, these covers, barriers or partitions may be omitted.

When cabinets have back wiring spaces which are not entirely enclosed, covers must be furnished to provide equivalent enclosure.

Cabinets made of wood or composition material, whether for flush or surface mounting must be rigid and substantial. Doors must fit closely. The detailed specifications for sheet metal cabinets must be followed so far as they apply.

(*c*) *Left blank for future use.*

(*f*) Wood, when used for the construction of cabinets must be well seasoned at least three-fourths inch in thickness and shall be thoroughly filled and painted. Cabinets made of wood must be completely lined with incombustible material firmly secured in place. Linings of slate, marble or approved composition must be at least one-quarter inch in thickness. Sheet metal, if used as lining must be at least No. 16 U. S. sheet metal gage. One-eighth inch rigid asbestos board may be used for linings when firmly secured in place.

(*g*) Cabinets built of composition material must be made up as is specified for wooden cabinets and must be submitted to the Inspector of Buildings for approval before being used.

(70) Cabinets and Cut-out Boxes—continued.

(*h*) Inside dimensions of wooden and composition cabinets must provide the spacings called for in Section (*d*) Paragraph 1-5, inclusive, of this rule. Barriers for gutters and wiring compartments must be provided when and as specified in Section (*d*), Paragraph 6.

(71) Rosettes:

(*For installation rules see* 23 (*d*).

(*a*) **Bases:**

Bases for the knob and cleat type must have at least two holes for supporting screws, must be high enough to keep the wires and terminals at least one-half inch from the surface to which the rosette is attached, and must have a porcelain lug under each terminal to prevent the rosette from being placed over projections which would reduce the separation to less than one-half inch.

Bases for the moulding and conduit box type must be high enough to keep the wires and terminals at least three-eighths inch from the surface wired over.

(*b*) **Rating:**

Fuseless rosettes may be rated 3 amperes, 250 volts; fused rosettes with link fuses, not over 2 amperes, 125 volts.

(*c*) **Fuses:**

Fused rosettes must have a fuse in each pole.

(72) Sockets and Lamp Receptacles:

(*For installation rules see No.* 31.)

(*a*) **Classification:**

Lamp holding devices to be classed according to diameters of lamp bases as Candelabra, Medium and

(72) Sockets and Lamp Receptacles—continued.

Mogul Base to be known respectively as ½ inch, 1 inch and 1½ inch nominal sizes, with ratings as specified in the following table:

Note.—660 watt sockets and receptacles are recommended for use wherever the attachment of flexible cords to them is likely.

RATINGS.

Class.	Nominal Diameter.	Key. Watts.	Key. Volts.	Key. Max. Amp. at Any Voltage.	Keyless. Watts.	Keyless. Volts.	Keyless. Max. Amp. at Any Voltage.
Candelabra	½ in.	75	125	¾	75	125	1
Medium	1 in.	250	250	2½	660	250	6
	(a)	660	250	6	660	600	
Mogul	1½ in.				1500	250	
	(b)				1500	600	

(*a*) This rating may be given only to sockets having a switch mechanism which produces both a quick "make" and a quick "break" action.

(*b*)

Miniature sockets and receptacles having screw shells smaller than the candelabra size may be used for Decorative Lighting Systems, Christmas Tree Lighting Outfits and similar purposes. See No. 37.

(*b*) Lining:

The inside of metal shells must be lined with insulating material, which must absolutely prevent the shell from becoming a part of the circuit, even though

(72) Sockets and Lamp Receptacles—continued.

the wires inside the sockets should become loosened or detached from their position under the terminal screws.

The lining must not extend beyond the metal shell more than one-eighth of an inch, but must prevent any current-carrying part of the lamp base from being exposed when a lamp is in the socket. The cap must also be lined.

(*c*) **Assembly:**

The socket as a whole must be so put together that parts will not rattle loose or fall apart under the most severe conditions they are likely to meet with in practice. The base of the socket must be secured or held in the shell in such a manner as to prevent turning or displacement relative to the shell.

(*d*) **Lead Wires:**

Lead wires furnished as a part of sockets and intended to be exposed after installation must be of approved stranded, rubber-covered wire, not less than No. 14 B. & S. gage, or (No. 18 B. & S. gage for candelabra sockets), and be sealed in place.

(73) *Left blank for future use.*

(74) *Left blank for future use.*

(75) *Left blank for future use.*

(76) Insulating Joints:

(*a*) Must be made of approved materials both for metal and other parts including the finishing materials for exterior and interior surfaces.

(*b*) Must have a substantial exterior metal casing insulated from both screw connections. This does not apply to studs or bolts.

(77) Fixtures:

(For installation rules see Nos. 30 and 35. For construction of fixture wires see No. 52.)

(a) Mechanical Construction:

Fixtures must be of metal or wood. Other materials may be used if approved by the Inspector of Buildings for the purpose intended. Materials other than metal must be reinforced by metal or the fixtures otherwise constructed to secure requisite mechanical strength.

In all fixtures not made entirely of metal, wire-ways must be metal lined unless approved armored conductors with suitable fittings are used. An exception is made in the case of wire-ways in glass, marble or similar non-absorptive incombustible insulating materials.

With screw joints of arms and stems there must be not less than five threads all engaging at fixture supports, fixture bodies and similar devices.

All methods of fastening arms, sockets and receptacles or making joints between metal parts by threading, soldering, brazing or otherwise, must be such as to secure in every case ample strength and reliability and to prevent turning.

All burrs and fins in wire-ways must be removed and all sharp edges at points where wires emerge from arms, stems, chains and similar devices, must, when practicable, be removed or rounded, but in every case it must be possible to pull in and also withdraw the wires without injuring them.

Where supply wires enter casings of fixture stems in either straight electric or combination gas and electric fixtures, there must be suitable fittings having smooth, rounded edges to prevent injury to the wire coverings and to prevent the wires from coming into contact with the edges of the ends of casings.

(77) Fixtures—continued.

Fixtures for installation outdoors or where exposed to moisture must be so constructed that water cannot enter the wire-ways, sockets or other electrical parts.

Each fixture shall be so wired that all screw shells of sockets are connected to the same fixture stem wire, or supply wire, or terminal in the fixture and this wire or terminal shall be marked in an approved manner by which it may be readily distinguished. The marked wire should be, in all cases the ground wire.

(*b*) **Electrical Construction:**

Conductors must be not smaller than No. 18 B. & S. gage.

On chains or similar parts where conductors are not completely enclosed in metal the conductors must be stranded and must have rubber insulation not less than 1/32 inch in thickness. Wires and flexible cords must, when fixtures are externally wired, be so secured as not to be cut or abraided by the pressure of the fastenings or motion of the fixture and must be protected against abrasion where they pass through sheet metal pans, canopies, and similar devices.

Conductors must be so spliced or joined as to be both mechanically and electrically secured without solder. The joints must then be soldered (unless made with some form of approved splicing device and covered with an insulation equal to that on the conductors, *i. e.*, with both rubber and friction tape. Wires must, within the arms and stems, be without splices and taps.

Receptacles having exposed terminals must not be used in canopies unless completely enclosed in metal.

(*c*) **Materials:**

Tubing used in threaded arms and stems must not be lighter than No. 18 B. & S. gage. Tubing must not be kinked, flattened or cracked.

(77) Fixtures—continued.

Canopies must be made sufficiently large except where outlet boxes are used, to permit the storing away of splices to fixture leads and to allow supply conductors and especially the splices to wire to be kept clear of the grounded part of gas pipes.

Conductors used in wiring fixtures must be approved flexible cord, or approved rubber covered wire, excepting that conductors having approved slow-burning or other heat-resisting coverings must be used in wiring fixtures in which the wiring is exposed from the heat of the lamps to temperatures in excess of 120 degrees Fahr. (49 degrees Centigrade).

All fixtures must where possible be sufficiently ventilated and the wiring must be so disposed as to avoid exposing the wiring to high temperature.

Canopy insulators, when required, must be of some approved type. They must be securely fastened in place so as to separate the canopies thoroughly and permanently from the surface and outlet boxes from which they are designed to be insulated. A strip of good grade of hard fibre 1/16 inch thick, permanently attached to the canopy at the ends, and at intermediate points in such a manner that the strip will permanently extend at least 3.16 inches beyond the entire upper edge of the canopy rim will be acceptable. Where the above construction is impractical a sheet of good grade of hard fibre 1/16 inch thick permanently attached to the canopy and cut to conform to the general outline of the canopy and with the edges of the sheet at least flush with the edges of the canopy will be acceptable. The insulating strip or sheet must be secured by rivets or screws and the rivets or screws must be so located or counter sunk that the desired effective insulation distance is obtained.

(78) Rheostats, Resistance Boxes and Equalizers:

(For installation rules see Nos. 4 (a) and 8 (c).

(*a*) **Types:**

Rheostats used in dusty or linty places or where exposed to flying of combustible material, must be so

(78) Rheostats, Resistance Boxes and Equalizers—continued.

constructed that even if the resistive conductor be fused by excessive current the arc or any attendant flame will be quickly and safely extinguished. Rheostats used in places where the above conditions do not exist may be of any approved type.

(*b*) **Mounting:**

Must be so constructed that when mounted on a plane surface the casting will make contact with such surface only at the points of support. An air space of at least one-fourth inch between the rheostat casings and supporting surface will be required.

(*c*) **Marking:**

The terminals of motor-starting rheostats must be marked to indicate to what part of the circuit each is to be connected as "line," "armature" and "field."

(*d*) **Contacts:**

The design of the fixed and movable contacts and the resistance in each section must be such as to secure the least tendency toward arcing and roughing of the contacts, even with careless handling or the presence of dirt.

In motor-starting rheostats the final contact, if any, on which the arm is brought to rest in the starting position must have no electrical connection.

(*e*) **No-Voltage Release:**

Motor-starting rheostats must be so designed that the contact arm cannot be left on intermediate segments, and for direct current circuits must be provided with an automatic device which will interrupt the supply circuit before the speed of its normal value. This rule may be omitted when controllers are installed with slip-ring motors.

(79) Auto-Starters:

(For installation rules see No. 8 (d).

Maximum of 100 *horse power and* 3,500 *volts.*

(Under this class are included all such devices for starting A. C. motors as employ transformer windings whereby the potential impressed upon the motor terminals during process of starting may be made less than the full line voltage and which have switching devices for accomplishing the result.

Apparatus designed for starting A. C. motors by employing ohmic resistance coils are to be as required under No. 78.)

(*a*) Coils and switches of auto-starters designated for use in dusty and linty places or where exposed to flyings of combustible material, must be completely enclosed in substantial metal cases so constructed as to effectually exclude ordinary dust, lint, or flyings of combustible material.

Auto-starters used in places where the above conditions do not exist may be of any approved type.

(*b*) Cases for either transformer coils or switches must provide for access to the interior for inspection and for renewal of oil, and dust be so constructed that when mounted on a plane surface the casing will make contact with such surface only at points of support. An air space at least one-fourth of an inch between the casing and supporting surface will be required.

(*c*) The oil tank shall be marked in a suitable manner to indicate the proper oil level. When such device carries a visual oil indicator, the marking shall be for the proper oil level with the starter assembled. If the visual indicator is not used, markings shall indicate the oil level prior to assembling.

(*d*) The switch must provide an off position, a running position and at least one starting position. It must be so arranged that it will be held in off and

(79) Auto-Starters—continued.

running positions but cannot be left in a starting position without the proper running overload protective devices in the circuit.

(80) Reactive Coils and Condensers:

(*a*) Reactive coils must be made of incombustible material, mounted on incombustible bases and treated, in general, as sources of heat.

(*b*) Condensers must be treated like other apparatus operating with equivalent voltage and currents. They must have incombustible cases and supports, and must be isolated from supports, and must be isolated from all combustible materials and, in general, treated as sources of heat.

(81) Air-Cooled Transformers:

(*For installation rules see Nos.* 11, 36 *and* 45.)

(The following sections do not apply to transformers installed in Central or Sub-stations (see No. 11), in fireproof vaults in buildings (see No. 45), nor to instrument transformers.)

Mounting:

(*a*) Must be so constructed that when mounted on a plane surface the casing will make contact with such surface only at the points of support. An air space of at least one-fourth of an inch between the transformer casing and the supporting surface is hereby required.

(*b*) Transformers for bell-ringing and other signaling service only may be used provided all the wiring on the high voltage side is in accordance with Class C. The rating of the high voltage winding must not be over 250 volts.

(82) *Left blank for future use.*

(83) Electric Signs (for Low-Potential Systems only):

(For installation rules see No. 23 (d).

(a) Material:

Must be constructed entirely of metal or other approved incombustible material, except that wood may be used on outside for decoration if kept at least two inches from nearest lamp receptacles.

Sheet metal must be not less than No. 28 U. S. metal gage.

All metal must be galvanized, enameled or treated with at least three coats of anti-corrosive paint, or otherwise protected in an approved manner against corrosion.

(b) Construction:

Must be so constructed as to secure ample strength and rigidity.

Must be so constructed as to be practically weatherproof and so as to enclose all terminals and wiring other than the supply leads, except that open work will be permitted for signs on roofs or open ground where not subject to mechanical injury, provided the wiring is in accordance with Section (e) below, and for temporary use only.

Transformers, unless of the weather-proof type, cut-outs, flashers and other similar devices, if on or within the body or structure of the sign, must be in a separate, completely enclosed, accessible weatherproof box or cabinet of metal of thickness not less than that of the metal of the sign itself.

The above devices if otherwise located must be enclosed in approved cut-out boxes or cabinets.

Each compartment must have suitable provision for drainage through one or more holes each not less than one-quarter inch in diameter.

(83) Electric Signs—continued.

(*c*) **Receptacles:**

Must be so designed as to afford permanent and reliable means to prevent possible turning; must be so designed and placed that terminals will be at least one-half inch from other terminals and from metal of the sign except where open work is permitted, this separation must be one inch.

Miniature receptacles will not be permitted for use in outdoor signs.

(*d*) **Wiring:**

Must be approved rubber covered, and not less than No. 14 B. & S. gage. Must be neatly run, and so disposed and fastened as to be mechanically secure.

Must be soldered to terminals, and exposed parts of wires and terminals must be treated to prevent corrosion.

Must where they pass through walls or partitions of the sign, be protected by approved bushings.

On outside of sign structures, the wires must be in approved metal conduit or in approved lead sheathed armored cable.

(*e*) Leads from sign must pass through the walls of sign either through approved metal conduit or armored cable, or must be neatly cabled and pass through one or more approved incombustible, non-absorptive bushings.

(*f*) Not over 1,320 watts shall be dependent upon final cut-out.

Circuits shall be so arranged that the number of outlets and the lamps connected to them shall in no case be such as to place more than 15 amperes on the branch circuit fuse.

(84) *Left blank for future use.*

Class E.

MISCELLANEOUS.

(85) Signaling Systems:

Governing wires for telephone, telegraph (except wireless telegraph apparatus).

District messenger and call-bell circuits, fire and burglar alarms, and all similar systems which are hazardous only because of their liability to become crossed with electric light, heat or power circuits.

(*a*) Outside wires should be run in underground ducts or strung on poles, and kept off of the roofs of buildings, except by special permission, and must not be placed on the same cross-arm with electric light or power wires. They should not occupy the same duct, manhole or handhole of conduit systems with electric light or power wires.

Single manholes or handholes separated into sections by means of partitions of brick, concrete or tile will be considered as conforming with the above rule.

Wires on the outside walls of buildings must not come nearer than four inches to electric light or power wires, except when in conduit, unless separated therefrom by a continuous and firmly-fixed non-conductor, to maintain permanent separation; this non-conductor to be in addition to the regular insulation on the wires.

Metal sheathed aerial cables which are liable to contact with electric light or power wires shall have the sheath interrupted close to the entrance to the building by means of an insulating joint or by equivalent means.

Sections (*b*) to (*h*) inclusive do not apply when the entire circuit is run in underground conduit from the central station to the block in which the building is located, provided the circuit within the block is so placed as to be free from chance of accidental contact with electric light and power wires of over two hundred and fifty volts.

(85) Signaling Systems—continued.

(*b*) When outside wires are run on same pole with electric light or power wires, the distance between the two inside pins of each cross-arm must not be less than twenty-four inches.

Signaling wires being smaller and more liable to break and fall, should generally be placed on the lower cross-arms.

When wires are carried in cables, Section (*c*), (*d*) and (*f*) do not apply. The cable may be of the metal sheath type with conductors insulated with paper or other suitable material, or it may be of the non-metallic sheath type in which case the insulation on the individual conductors shall conform to the requirements of Section (*c*) except that the protective covering on individual conductors may be omitted.

(*c*) Where wires are attached to the outside walls of buildings, they must have approved rubber insulating covering, and of frame portions of other buildings shall be supported on glass or porcelain insulators or knobs.

(*d*) The wires from last outside support to the cut-out or protectors must be of copper, and must have an approved rubber insulation, and be provided with drop loops immediately outside the building and at entrance.

(*e*) Wires must enter building through approved incombustible, non-absorptive, insulating bushings sloping upward from the outside and both wires may enter through the same bushing if desired.

Installation Where the Current-Carrying Parts of the Apparatus Installed are Capable of Carrying Indefinitely a Current of Ten Amperes:

(*f*) An all-metallic circuit shall be provided, except in telegraph systems.

(*g*) At the entrance of wires to building, approved single pole cut-outs, designed for 250-600 volts poten-

(85) Signaling Systems—continued.

tial and containing fuses rated at not over ten amperes capacity, shall be provided for each wire. These cut-outs must not be placed in the immediate vicinity of easily ignitible materials, or where exposed to inflammable gases, or dust or to flyings of combustible materials.

(*h*) The wires inside building shall be of copper not less than No. 16 B. & S. gage, and must have insulation and be supported the same as would be required for an installation of electric light or power wiring 0-600 volts potential.

(*i*) The instruments shall be mounted on bases constructed of incombustible, non-absorptive, insulating material. Holes for the supporting screws must be so located, or countersunk, that there will be at least one-half inch space, measured over the surface, between the head of the screw and the nearest live metal part.

Installation Where the Current-Carrying Parts of the Apparatus Installed are not Capable of Carrying Indefinitely a Current of Ten Amperes:

(*j*) Must be provided with an approved protective device located as near as possible to the entrance of wires to building. The protector must not be placed in the immediate vicinity of easily ignitible materials, or where exposed to inflammable gases or dust or flyings of incombustible materials.

(*k*) Wires from entrance to buildings to protector must be supported on porcelain insulations so that they will come in contact with nothing except their designed supports.

(*l*) The ground wire of the protective device shall be run in accordance with the following requirements:

1. Shall be of copper and not smaller than No. 18 B. & S. gage.

(85) Signaling Systems—continued.

2. Must have an insulating covering approved for voltage from 0-600 except that the preservative compound may be omitted.

3. Must be run in as straight a line as possible to a good permanent ground. This may be obtained by connecting to a water pipe connected to the street mains or to a ground rod or pipe driven in permanently damp earth. When connections are made to pipes, preference shall be given to water pipes. If attachments are made, the connection in all cases must be made between meter and street mains. In every case the connection shall be made as near as possible to the earth.

When the ground wire is attached to a water pipe, it may be connected by means of an approved ground clamp fastened to a thoroughly clean portion of said pipe, or the pipe shall be thoroughly cleaned and tinned with rosin flux solder, and the ground wire shall then be wrapped tightly around the pipe and thoroughly soldered to it.

When the ground wire is attached to a ground rod driven into the earth the ground wire shall be soldered to the rod in a similar manner.

Steam or hot water pipes must not be used for a protector ground.

(*m*) The protector to be approved must comply with the following requirements:

For Instrument Circuit of Telegraph Systems:

1. An approved single pole cut-out on each wire, designed for 2,000 volts potential, and containing fuses rated at not over one ampere capacity. When main line cut-outs are installed as called for in Section (*g*), the instrument cut-outs may be placed between the switchboard and the instrumnt as near the switchboard as possible.

(85) Signaling Systems—continued.

For All Other Systems:

1. Must be mounted on incombustible, non-absorptive, insulating bases, so designed that when the protector is in place all parts which may be alive will be thoroughly insulated from the wall to which the protector is attached.

2. Must have the following parts:

A lighting arrester which will operate with a difference of potential between wires of not over 500 volts, and so arranged that the chance of accidental grounding is reduced to a minimum.

A fuse designed to open the circuit in case the wires become crossed with light or power circuits. The fuse must be able to open the circuits without arcing or serious flashing when crossed with any ordinary commercial light or power circuit.

A heat coil if the sensitiveness of the instrument demands it, which will operate before a sneak current can damage the instrument the protector is guarding.

Heat coils are necessary in all circuits normally closed through magnet winding, which cannot indefinitely carry a current of at least five amperes.

3. Heat fuses must be so placed as to protect the arrester and heat coils, and the protector terminals must be plainly marked "line," "instrument," "ground."

An easily read abbreviation of the above words will be permitted.

The following rules apply to all systems whether the wires from the central office to the building are overhead or underground.

(*n*) Wires beyond the protector, or wires inside buildings where no protector is used, must be neatly arranged and securely fastened in place in some convenient, workmanlike manner.

(85) Signaling Systems—continued.

They must not come nearer than two inches to any electric light or power wire in the building, unless separated therefrom by some continuous and firmly fixed non-conductor creating a peremanent separation; this non-conductor to be in addition to the regular insulation on the wire.

(*o*) Wires where bunched together in a vertical run within any building must have a fire-resistive covering sufficient to prevent the wires from carrying fire from floor to floor unless they are run either in incombustible tubing or a fireproof shaft.

Signaling wires and electric light or power wires may be run in the same shaft, provided that one of these classes of wires is run in incombustible tubing, or provided that when run otherwise these two classes of wires shall be separated from each other by at least two inches.

In no case shall signaling wires be run in the same tube with electric light or power wires.

(*p*) Transformers or other devices for supplying current to signaling systems from light, heat or power circuits must be of a design expressly approved for this purpose. The primary wiring must be installed in accordance with the rules for "Class C" and the secondary wiring in accordance with "Class E."

(86) Wireless Telegraph Apparatus:

In setting up wireless telegraph apparatus (so-called) all wiring pertaining thereto must conform to the general requirements of this Code for the class of work installed and the following additional requirements:

(*a*) Aerial supports to be constructed and installed in a strong and durable manner, and aerial conductors, with wires leading from same to ground switch, must be supported on approved insulators, and these conductors to be kept at a distance of not less than

(86) Wireless Telegraph Apparatus—continued.

8 feet from the building except where entering same through approved incombustible, non-absorptive insulators.

(*b*) Aerial conductors to be permanently and effectively grounded at all times when station is not in operation by a conductor not smaller than No. 6 B. & S. gage copper wire, run in as direct a line as possible to water pipe, said waterpipe within the premises, or to some other equally satisfactory earth connection or to such other ground as may be allowed by special permission in writing by the Inspector of Buildings.

(*c*) Or the aerial to be permanently connected at all times to earth in the manner specified above, through a short-gap lighting arrester; said arrester to have a gap of not over .015 inch between brass or copper plates not less than 2½ inches in length parallel to the gap and 1½ inches the other way, with a thickness of not less than one-eighth inch mounted upon incombustible, non-absorptive, insulating material of such dimensions as to give ample strength. Other approved arresters of equally low resistance and equally substantial construction may be used.

(*d*) In cases where the aerial is grounded as specified in Section (*b*) the switch employed to join the aerial to the ground connection shall not be smaller than a standard 100 ampere knife switch.

(*e*) Where supply is obtained direct from the street service the circuit must be installed in approved metal conduits or armored cable. In order to protect the supply system from high potential surges, there must be inserted in circuit either a transformer having a ratio which will have a potential on the secondary leads not to exceed 550 volts or two condensers in series across the line.

(*f*) Transformers, voltage reducers or similar devices must be of some approved type.

(87) *Left blank for future use.*

(88) Insulating Resistance, Light and Power Circuits:

Where a test of the wiring of a building is required by the Inspector of Buildings the wiring must comply with the following requirements:

The complete installation must have a resistance between conductors and between all conductors and the ground (not including attachments, sockets, receptacles and similar devices) not less than that given in the following table:

Up to	5 amperes.....	4,000,000 ohms
Up to	10 amperes.....	2,000,000 ohms
Up to	25 amperes.....	800,000 ohms
Up to	50 amperes.....	400,000 ohms
Up to	100 amperes.....	200,000 ohms
Up to	200 amperes.....	100,000 ohms
Up to	400 amperes.....	50,000 ohms
Up to	800 amperes.....	25,000 ohms
Up to	1,600 amperes.....	12,500 ohms

The test must be made with all cut-outs and safety devices in place. If lamp sockets, receptacles, electroliers and similar devices are also connected, only one-half of the resistance specified in the tables will be required.

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